Sustainable Governance and Management of Defined Benefit Plans in the Public Sector: Lessons from the Turbulent Decade of 2000-2009

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Sustainable Governance and Management of Defined Benefit Plans in the Public Sector: Lessons from the Turbulent Decade of 2000-2009

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This dissertation is dedicated to my mother.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BBR	Balanced Budget Requirement
CAFR	Comprehensive Annual Financial Report
COLA	Cost of Living Adjustment
CPS	Current Population Survey
DB	Defined Benefit
DC	Defined Contribution
ETI	Economically Targeted Investments
FAS	Final Average Salary
GAO	Government Accountability Office
GASB	Governmental Accounting Standards Board
NASBO	National Association of State Budget Officers
NASRA	National Association of State Retirement Administrators
OLS	Ordinary Least Squares
PFS	Public Fund Survey
2SLS	Two-Stage Least Squares
3SLS	Three-Stage Least Squares

SUMMARY

This study examined the determinants of public pension fund performance through the lens of agency theory. The study sought to answer the following questions: (1) How much of the fluctuation in the performance of pension plans is due to political interference – either directly from decisions made by legislatures or through the governance structure of the pension boards, after controlling for asset allocation, plan size, and other external factors? (2) Do pension board expertise, education and training, and information disclosure requirements improve the performance of pension plans? (3) Do pension trustees strategically determine the actuarial rate of return (discount rate) in order to reduce contributions in times of fiscal stress for the pension sponsor? Using longitudinal data of pension fund performance over the period 2000 to 2009 and instrumental variables methods to address endogeneity issues, the study found partial support for the agency theory hypotheses. The results indicate that political interference through reduced contributions was the main factor explaining pension performance. There was no direct evidence about the negative impact of politically appointed trustees on pension performance. The impact of these findings for current policy and future research are discussed.

CHAPTER 1: INTRODUCTION

Introduction

The pension systems for state and local government workers are major providers of retirement income, as well as significant investors in US and international markets. According to the US Census Bureau (2010), in 2008, the total number of members in these systems was 19 million, of which 7.5 million received some kind of benefits. Cumulatively, state and local pension systems held over $3 trillion in assets in that year and indicated the use of a variety of investment options. Most notably, more than $1 trillion was invested in domestic corporate stocks, and $500 billion in international stocks. Given such economic and social importance, the performance of these systems has attracted significant attention from the general public as well as from academics.

A great deal of attention has focused on the funding levels of public pension plans. The funding level – the ratio of assets to the present value of liabilities – is an indicator of the ability of the plan to pay accumulated benefits in the future. Assets include employer and employee contributions as well as investment returns. Due to the increased investment in equities in the 1990s, investment returns have become the largest component of pension assets, accounting for almost three quarters of all pension assets, and the rest comprised of employee and employer contributions (Almeida et al., 2009). Pension liabilities depend on the benefit parameters of the plan, as well as actuarial assumptions built into the calculation of their present value so that they can be compared to current assets. Benefit parameters include among others the benefit multiplier (usually increasing with years of service), which determines the monthly pension benefit based on the final average salary (FAS) and years of service. Other key benefit

parameters are the early and the normal retirement age, cost-of-living adjustments (COLAs), and vesting period (the years of service necessary for employees to have full rights over accumulated benefits). The actuarial assumptions include demographic and economic indicators that vary with the nature of the pension plan. Economic assumptions include estimates of investment return (a function of the investment strategy of the pension plan), payroll growth, and inflation. And, non-economic assumptions include forecasts of retirement rates, withdrawal rates, and mortality rates, which are adjusted periodically based on the actual experience of the pension plan.

Motivation for the Study

Pension sustainability is defined in this research as the ability of the pension sponsor to pay promised benefits over the long run. Following this definition, sustainability is measured by the funded ratio of the pension plan. Although the goal of Governmental Accounting Standards Board (GASB) requirements is for pension plans to be fully funded (100% or higher), a 2008 GAO study reports that pension experts consider 80% or higher funding ratio to be acceptable for public plans. Part of the reasoning behind this rule-of-thumb is that pension plans only started working towards full funding in the 1990s as a result of the GASB requirements and they have 30 years to reach full funding. Another reason why pension plans do not need to be fully funded lies in the nature of the pension plan sponsor. State and local government have a very low probability of going into bankruptcy, therefore, full funding is not necessary as it is in the private sector (Munnell et al., 2008).

Concerns over the sustainability of public pension systems have been driven, of late, by relatively recent guidelines by GASB regarding the accounting and reporting of pension liabilities. GASB Statement 25 and Statement 27 significantly revised the existing pension

accounting and reporting guidelines in 1994 for state and local pension plans. Both were amended by Statement 50 in 2007 to reflect changes in reporting for all post-employment benefits, including health care benefits, which are for the most part unfunded. Currently, there is an ongoing effort to further revise guidelines in order to address concerns about the transparency and accounting practices of the existing pension financial reports (GASB, 2009). GASB issued a preliminary statement in 2010 that if implemented would change, among other things, the pension liability account for by governments from the annual unfunded obligation (the difference between required contribution and actual contribution) to the total unfunded obligation (the difference between assets and liabilities) (GASB, 2010).

Interest in these systems is further piqued by media reports regarding the mismanagement of investments, deferrals of pension contributions by state and local governments, especially during economic downturns, and ever growing unfunded liabilities. With the onset of the Great Recession and the extreme stock market losses in 2008, state and local pension funds were again in the public limelight. A series of articles in 2010 focused on the impact of the latest market losses on pension liabilities and future contributions. One article warned about a "death spiral" for public pension funds because of their growing benefit payments as a percent of assets and their low average investment returns in the last decade (McNichol, 2010). In Missouri, the Public School Retirement System was considering pension reforms in the face of expected increases in the contribution rates from 14% to 19.5% (Young, 2010). As actuarially-determined required contributions fluctuate with pension funding levels, this story applies to the majority of public pension system who would have to find ways to increase their pension contributions with already strained state and local budgets.

The unprecedented losses in 2008 have triggered pension reforms throughout state and local governments due to the significant drop in their funding status (Snell, 2010). Most of the enacted reforms after the market downturn include increases in employer and employee contributions, as well as benefit cuts in different forms (Snell, 2010). But the exposure of public pension systems during the economic downturn has also generated a lot of research on the impact of their current accounting and actuarial practices. Specifically, a very active line of research has focused on how the reported pension liabilities change with different discount rates than those currently used by pension funds, indicating even much larger liabilities than those reported by pension plans (Novy-Marx and Rauh, 2010; Brown et al., 2010).

The drop in pension funding levels and the pressure that pension liabilities put on state and local budgets have prompted Moody's Investors Service to begin considering these liabilities when appraising state credit ratings (Walsh, 2011). Although the potential for this has always been brought up as one of the concerns regarding pension liabilities, the move by Moody's signifies a sharp shift in how pension liabilities are perceived. State and local governments now will have to account for these liabilities in the same way they account for any other public debt. Therefore, the impact of accumulating unfunded liabilities will be felt immediately by states through increases in their borrowing costs.

Attempts to allay concerns about the current funding status of public pension plans are made by some who argue that the funding status at any given point in time is not important due to the taxing power of the plan sponsor. Since state and local governments are expected to exist in perpetuity, they will be able to generate the revenues necessary to meet pension obligations. However, one of the main rationales for pre-funding pension plans is the principle of intergenerational equity, i.e., current taxpayers should pay for the services that they currently

receive. Pensions and other post-employment benefits are part of the compensation package of public employees, and therefore need to be paid as these government services are rendered (GASB, 2009, p.4). Yet, demographic shifts that increase the ratio of retirees to workers and sustained taxpayer efforts to impose constraints on the taxing power of governments compromises the funding status of public pensions and reinforces the need for the sustainable management of these plans.

Generally, the funding status of public pension plans has followed the cyclical financial market performance. The funding ratios of many state and local pension systems improved in the 1990s with the strong performance of the stock market, and as a result of increased equity holdings in the portfolios of these systems. Mostly reflecting high investment returns, the mean funding ratio increased from 86 percent in 1990 to 99 percent in 2000 (Yang and Mitchell, 2005).[1] With much higher returns than expected, many governments used flush revenues as an excuse to expand the benefits provided by their pension plans. In some instances, benefit increases substituted for pay increases in order to attract and retain public sector workers. But the implications for the actuarial value of pension liabilities were not taken into account. A case in point is the City of Atlanta – benefit increases were approved in 2001 and 2005 and were already putting pressure on the City budget by 2009. In fact, annual pension costs have tripled since 2001 and by 2008, the City spent 20 percent of its budget on pension benefits (McWhirter, 2009).

Furthermore, the high investment returns in the 1990s created a "contribution holiday" for many governments because assets grew at much higher rates than expected. Instead of using the excess revenue to cushion against the proverbial rainy day – an economic downturn –

[1] Yang and Mitchell, 2005, Table 1, p. 28. These numbers are from the PENDAT survey dataset; the number of systems responding to the survey varies each year.

governments reduced their contributions to pension systems. PENDAT[2] data reveals that the mean contribution rate dropped from about 12.9 percent in 1990 to 11.8 percent in 2000 (Yang and Mitchell, 2005). During the economic decline of 2001 and 2002, when investment returns then worsened, governments not only were unable to increase system contributions, but many even reduced or deferred contributions into pension systems to balance state budgets.

Unfortunately, state and local governments appeared to rely heavily on risky stock market returns to sustain their pension plans. However, the turbulent financial markets in the past decade exposed the dangers of such an approach, especially when it does not account for the potential disruptions of significant market downturns. The frequency and severity of the market downturns after 2000 and their impact on state and local government finances imply that public pension sponsors need to reconsider their approach to pension management. Simply put, governments have favored short term over long term budget strategies in the management of their pension funds.

This research examines the conflict between short and long term management of public pensions, explains "best practices" related to long term pension management and examines factors that most positively and negatively influence pension management through up and down economies. Specifically, this work seeks to answer the following questions: (1) How much of the fluctuation in the performance of pension plans is due to political interference – either directly from decisions made by legislatures or through the governance structure of the pension boards, after controlling for asset allocation, plan size, and other external factors? (2) Do pension board expertise, education and training, and information disclosure requirements improve the

[2] The PENDAT survey was a longitudinal survey of public pension systems and plans conducted in the 1990s through 2000 by the Public Pension Coordinating Council (Zorn, 2001). The exact years of the survey include 1990, 1991, 1992, 1994, 1996, 1998, 2000. The number of respondents for every year of the survey varies. Survey data include governance, financial management, benefits and other plan parameters.

performance of pension plans? (3) Do pension trustees strategically determine the actuarial rate of return (discount rate) in order to reduce contributions in times of fiscal stress for the pension sponsor?

Contribution to the Literature

While there has already been some interest in the governance of pension systems, results from the research to date are inconclusive. Perhaps more importantly, little to no attention has been paid to public pension performance in a down economy. Early studies (Romano, 1993; Hsin & Mitchell, 1997; Chaney et al. 2002) provide intriguing findings about the impact of fiscal stress on pension health, but are limited by the lack of comprehensive data on a majority of pension systems and given their cross-sectional nature. The latest published studies about public pension governance and management (Hess, 2005; Useem & Mitchell, 2000; Yang & Mitchell, 2005) use a longitudinal survey of pension systems known as the PENDAT. The PENDAT provides rich material for examining the factors driving pension performance, but the data is limited by the fact that it was collected in the 1990s, a period characterized by strong stock market performance and high investment returns for pension plans.

This study examines only defined-benefit (DB) public pension plans.[3] There are very few public stand-alone defined-contribution (DC) plans (Alaska, Michigan), although many retirement systems offer an optional or supplemental defined-contribution or hybrid plan together with the defined-benefit plan. The optional DC plans have been introduced in an effort to provide more flexible retirement options for public employees. However, the membership in alternative pension plans is relatively minor compared to total membership in DB plans.

[3] Defined-benefit pension plans promise a fixed benefit after retirement depending upon length of service and final salary of the beneficiary. These plans obligate to benefit payments, regardless of pension investment performance.

The study uses a new public pension dataset for fiscal years 2000 through 2009, a period of significant stock market fluctuation. The goal of this research is to investigate pension management in such a period and generate recommendations about best practices for pension management given this environment. Further, this research models the interplay of political, governance, and financial management factors using agency theory as a framework. This approach structures more rigorously the discussion of expected relationships. The empirical methods take into account the simultaneous determination of the funding status, investment return, and assumed rate of return. The panel dataset allows the use of fixed effects methods and simultaneous equations methods in order to control for endogeneity due to unobserved fixed effects or simultaneous determination.

CHAPTER 2: GOVERNANCE AND THE FINANCIAL MANAGEMENT OF PUBLIC PENSION SYSTEMS

There are two outcomes used as measures for the short-term and long-term performance of pension systems – the investment return and the funding ratio. The investment return is determined by the financial management and asset allocation decisions for the particular pension fund. The funding ratio is determined by the contributions to the plan, investment gains, and changes in pension liabilities. There have been a number of studies that examine the determinants of these outcomes. Additionally, several studies have looked at whether actuarial assumptions are determined strategically depending on the fiscal condition of the pension sponsor rather than reflecting the true characteristics of the pension plan. This section reviews the literature on the determinants of investment return, pension funding, and actuarial assumptions.

Governance, Financial Management, and Investment Return

Romano (1993) was among the first to examine the effect of pension governance, specifically board composition, on investment return for state pension systems. The focus in the study is on pension fund activism and corporate governance, but she also explores the effect of board composition on public pension investment returns. The study uses random effects panel methods with five years of data for the 50 state public employee retirement systems, from 1985 to 1989. Romano finds that board trustees elected by pension fund members are associated with stronger investment performance, after controlling for asset allocation. These findings are in line with expectations that politically appointed trustees may not select the most optimal investment strategies due to political pressure. Romano also argues that the key factor in this relationship is

that trustees are elected, and therefore held accountable to pension members through the election process, not that they are pension plan members only. She finds pension membership to be an insignificant predictor of investment performance. Romano also reports a negative impact of policies of investment restrictions, including economic investments and international restrictions, on investment return.

Coronado et al. (2003) also study the impact of board composition, as well as in-state investments and investment restrictions, on the financial return of public pension plans. Their sample is based on one year of PENDAT data, with a total of 246 retirement systems responding for fiscal year 1998, and the model is estimated with linear regression. They find a positive, but insignificant, relationship between elected trustees and investment return, and negative, also insignificant, relationships between in-state investments and investment restrictions on the one hand, and investment return on the other. Furthermore, they find that the investment returns of public plans are lower than those of comparable private plans after controlling for equity allocation, plan size, board composition, and investment practices. They conclude that this effect is most likely due to political influence that is not adequately captured by the variables in their study, that include board composition, in-state investments and investment restrictions. However, their findings are limited by the cross-sectional data.

On the other hand, Murphy and Van Nuys (1994) do not find any such differential in the performance of public and private pension plans after controlling for asset allocation and plan size. They argue that the main goal of plan member trustees is to maximize the security of their pensions rather than investment returns. Unlike Romano (1993), they focus on all plan member trustees (active and retired), not only on elected member trustees, as a predictor of investment

performance.[4] The sample in their study consists of all state administered pension systems, a total of 107 in 1992, and investment data for 1988 to 1992. The OLS estimates for investment performance indicate a negative (and marginally significant) relationship between trustees who are retirees and investment return. They also find that portfolio allocations are more conservative when there are more retirees on the board of trustees, which may explain the lower investment returns of such pension plans.

Useem and Mitchell (2000) examine the impact of governance policies on investment return with a focus on the intermediary role of investment strategies. Governance policies expected to influence performance in their study include statutory investment restrictions, independent investment performance evaluations, responsibility of the board for asset allocation and investment decisions, and the size and composition of the board. The investment strategies include tactical investment, equity investment, external investment management, and international investment.[5] The data analysis is based on 1992 and 1993 PENDAT data, with a final sample of 104 pension systems. They measure investment performance with the lagged investment return and estimate their models with OLS.

They find that governance policies influence investment return only indirectly, through the choice of investment strategies. Even then, board composition does not appear to be a predictor of investment outcomes. Specifically, they find that constitutional restrictions on investment are associated with less tactical, equity and international investments. Systems with

[4] Plan member trustees may be appointed or elected to the Board. Consequently, the overall proportion of plan member trustees is higher than the proportion of elected plan member trustees.

[5] Tactical investment refers to strategic changes of asset allocation over time. Equity investment is the percent of assets invested in stock, real-estate and other equities. Outside investment management refers to the contracting out of asset management. International investments are comprised of non-US stocks and bonds (Useem and Mitchell, 2000, p. 493-494).

independent evaluations[6] invest more in equities and internationally. Larger boards are more likely to invest in equities and internationally, and less likely to contract out investment management. Investment strategies, in turn, are the key predictors of investment return. Specifically, higher allocations to equity and international investments are associated with higher investment return. This is another study limited by the cross-sectional analysis and timing of the study – conducted in a period of high stock-market returns that drive investment performance.

Yang and Mitchell (2005) examine the determinants of investment return and pension funding with seven years of PENDAT data, using pooled OLS regressions to estimate a set of three equations in order to address endogeneity issues. Similarly to Murphy and Van Nuys (1994), they find that pension investment performance suffers if a greater proportion of the trustees are retired plan members. This result may reflect one of several underlying causes. Either plan members engage in less risky investments in order to protect the security of their benefits (as argued by Murphy and Van Nuys (1994)), or they simply do not have any incentives to monitor the performance of the pension plan since their benefits are guaranteed. Alternatively, it is possible that retired trustees are less likely to have financial management expertise and therefore make suboptimal investment decisions. Further, the authors find that annual reports sent automatically to all pension system members improves investment performance, though conducting an independent performance evaluation of a system was not found to be a significant predictor of investment return. In line with the results of Useem and Mitchell (2000), Yang and Mitchell (2005) find that a higher percentage of equity investment is associated with higher investment return.

[6] Some retirement systems contract with an external organization to conduct a periodic independent performance evaluation (annual or quarterly), which compares its investment performance to that of other funds.

Another study using data for all years from the PENDAT survey was conducted by Hess (2005) with a focus on governance and investment performance. Hess focuses on single-equation estimation of investment performance, using OLS regressions, and therefore, does not address endogeneity concerns, although he employs a longitudinal dataset. He examines how investment returns vary with board composition and board decision authority, as well as the presence of prudent person principle[7] and ethics code, and automatic distribution of the annual report, which are deemed to potentially control agency issues. Hess finds that systems with boards with higher proportions of appointed trustees indicate better investment performance, contrary to expectations based on agency theory. He also reports a curvilinear relationship between boards with higher proportions of member-elected trustees and investment return – initially performance improves, but as more of these members make up the board, returns diminish. These findings partially support agency theory, but indicate that there are other factors particular to board composition that may influence investment performance, such as the expertise of the trustees. If appointed trustees are more likely to have investment experience, then they will make better investment decisions overall. However, if there is political pressure to invest in suboptimal but politically preferred investments the two effects operate in the opposite direction and will be difficult to distinguish empirically when using only appointed status as an independent variable.

Surprisingly, requirements for distributing annual reports to all system members and the existence of an ethics code appear to negatively impact investment performance. Perhaps such controls restrain board members from investment decisions of higher risk that potentially produce higher returns. Additionally, Hess finds that board authority over asset allocation is

[7] Prudent person principle is a guideline that is explicitly specified for the majority of pension boards that they will manage the pension assets as would a prudent person given the information that they have at their disposal.

associated with lower investment return; he explains this result as the lack of expertise in tailoring the appropriate asset allocation strategy for the particular pension system. When pension boards do not have investment authority, there is usually a separate investment board composed of professionals who are responsible for asset allocation and other financial management decisions.

Although there is not much formal analysis about the impact of trustees' expertise and training on pension performance in the U.S, concern with these issues was brought up by the 2001 Myners Report on institutional investors in Britain. The majority of the surveyed trustees were found to have no professional qualifications in financial management; they were exposed to very little training and afforded limited preparation before investment meetings of the board. The report further indicates that pension trustees cannot properly evaluate the recommendations of external investment managers or tailor an optimal investment strategy for their pension fund. Given the nature of the trust organization, there are two approaches to this problem according to Clark (2004). Either trustees can be required to have the necessary expertise to engage in financial management decisions, or the pension system can employ internally investment managers who would be accountable to the particular pension system in order to avoid another set of agency problems between the trustees and the consultants. The report suggests, however, that the second option would be cost-effective only with larger pension funds because they need to pay competitive salaries in order to attract high quality financial managers.

In summary, previous studies of the impact of pension governance and financial management on investment return have employed different approaches to the specification of the models and the empirical testing, and therefore their results are not directly comparable and may account for the different findings. Most of these studies are cross-sectional and employ single-

equation models, and only Yang and Mitchell (2005) attempt to control for possible endogeneity problems, although they employ pooled OLS, which does not control for unobserved fixed effects. Romano (1993) and Hess (2005) focus on member-elected trustees, while the other studies use all pension member trustees in their board composition variable. They also use different measures of investment return, due to data availability. Finally, no study has examined directly the impact of education and training requirements of board members on pension performance, although these relationships have been discussed tangentially in the discussion of the results. This study builds on the existing literature by improving the estimation methodology in order to account for the endogeneity of the investment and funding variables. It will also be the only study in the extant literature to capture the separate effects of board composition and financial expertise on investment performance.

Governance, Fiscal Stress, and Pension Funding

Two of the studies discussed above also examined the impact of governance on pension funding. Murphy and Van Nuys (1994) studied in a separate equation the impact of board composition on pension funding for the period 1988 to1992. Their analysis shows that active members on the board of trustees of pension systems are associated with higher funding levels. The coefficient for retirees is positive, but not significant. These findings support expectations based on agency theory that plan member trustees are more likely to be concerned with the long-term sustainability of pension plans and less likely to be influenced by political pressures. However, their analysis is based on pooled OLS regressions and controls only for plan size and year effects and not for fiscal stress and investment returns.

Yang and Mitchell (2005) study the determinants of stock funding (the ratio of assets to liabilities) and flow funding (the ratio of actual to required contribution) in a multi-equation

model. They find that plan members on the board of trustees, both retired and active, are associated with lower funding ratios, in contrast with expectations from agency theory. Again, this measure of board composition is different than the one used by Romano, which focuses on elected trustees. Most importantly, the authors also refute the conclusions of earlier studies of Chaney et al. (2002) and Eaton and Nofsinger (2004) by finding that fiscal stress and balanced budget requirements at the state level are not significant predictors of pension funding levels. However, Yang and Mitchell (2005) measure fiscal stress as the deviation of the unemployment rate from the ten-year average, while other studies employ measures focused on the actual strain on the budget, such as debt ratios and budget balances.

The Chaney et al. (2002) study tests whether the presence of state-level fiscal stress and balanced budget requirements are associated with pension underfunding. They measure state fiscal stress with the year-end budget balance, but also include long-term general obligation debt, bond rating, and tax capacity as supplementary measures of fiscal condition. OLS data analysis is based on cross-sectional data for state pension plans in 1994-1995. They find strong statistical significance for all fiscal constraint variables, indicating that pension funds are used as a source for balancing state budgets. The mechanism through which this most commonly happens are reduced employer contributions, but also changes to the assumed rates of investment return may occur and this too can lead to lower required contributions. The limitation of their study is the cross-sectional data and the lack of other explanatory variables, such as governance factors and investment return.

Another study focusing on the impact of fiscal constraints on pension funding was done by Eaton and Nofsinger (2004) with five years of PENDAT data in the 1990s. The authors compare the funding levels of pension plans whose sponsors experience fiscal constraints,

measured by the ratio of interest payments to revenue and debt to revenue at the state level. Additionally, they control for political pressure with an indicator variable for whether the plan is engaged in economically targeted investments and investment restrictions. They estimate the models with OLS methods for all observations. They find that pension sponsors with higher levels of fiscal constraints and with political pressure realize lower funding levels. Similarly to Chaney et al., the authors do not control for board composition or investment returns as determinants of pension funding.

One of the most recent studies regarding the determinants of pension funding was conducted by Harper (2008). He uses data for fiscal years 2001 through 2005 including a total of 69 public pension systems (33 state and 36 municipal) for each year. This is the only study, other than Yang and Mitchell's (2005), that uses a multi-equation estimation to address endogeneity issues. Harper's theoretical approach challenges some of the assumptions based on agency theory. He argues that plan members may have stronger incentives to engage riskier investments as higher returns are more likely to translate into benefit increases, while lower returns are not likely to decrease their benefits. This is premised on the fact that most public pensions remain defined-benefit and that large unfunded liabilities would not impact pension design, which may not be the case as illustrated by the pension reforms initiated after the 2008 financial market collapse. It also assumes that employee contributions will not rise due to worse than expected investment performance.

Contrary to his expectations, Harper finds that both elected and appointed trustees exhibit a more conservative investment strategy by allocating fewer assets to equities. These findings suggest that elected trustees are risk-averse rather than risk-taking, and appointed trustees appear to avoid negative publicity from poor performance by investing in less risky assets. Elected and

ex-officio trustees are associated with higher funding ratios. His findings indicate that agency problems may be alleviated by the high reputation stakes for ex-officio trustees, but the impact of potential agency problems for appointed trustees is not clear.

Overall, studies of pension funding have focused on either the governance factors or fiscal stress as determinants of pension funding. Although the cross-section studies and anecdotal evidence seem to indicate that fiscal stress is associated with reduced contributions to pension fund, longitudinal studies do not find such an effect after controlling for governance factors and investment return, as illustrated by the results in Yang and Mitchell (2005). The existing literature also finds conflicting results about board composition and the potential political interference in funding decisions. The only two studies that attempt to control for the endogeneity of pension funding decisions (Yang and Mitchell (2005) and Harper (2008)) find conflicting results regarding board composition, but they measure the number of plan members on the board differently. They are further not comparable because Harper (2008) does not include measures of fiscal stress in his models.

Actuarial Assumptions and Pension Funding

A great concern about the sustainability of pension systems regards the ability of state and local governments to defer contributions during a down economy or to exert pressure on board members to change the actuarial assumptions in order to lower the actuarially-determined required contributions. The latter problem is more difficult to observe, though it has serious implications about the long-term sustainability of a pension system by undermining its actual funding status. For example, an increase in the assumed long-term rate of investment return would result in lower required contributions today because assets are expected to grow at higher

rates in the future. However, this problem is not possible to observe until investment returns do not realize in the future and expose the underfunding of the pension plan.

The few studies that have examined directly the question of the possible manipulation of the actuarial assumptions find significant results from their estimations. Among the three studies discussed here, only Hsin and Mitchell (1997) examine both fiscal stress and pension governance factors in their analysis, while the other two studies focus on fiscal stress only. Hsin and Mitchell use 1992 PENDAT data, with a total of 325 systems (85 state and 240 local), to estimate the impact of governance and fiscal stress on actuarial assumptions and actual employer contributions. They measure fiscal stress as the deviation of the current year unemployment rate from the five-year average. They find that plans with more elected board members have lower assumed interest rates and spread rates (difference between the interest rate and the wage growth rate). The lower rates result in higher actuarially required contributions to the pension fund, and consequently better funding.

Their results are consistent with agency theory, which expects that pension members on the board of trustees would not be influenced by political pressure in their decisions. Further, the tendency to manipulate assumptions is stronger when the state is experiencing an economic downturn, although the coefficient is significant only for the spread rate, not for the discount rate. They also find that well-funded plans choose lower actuarial rates, which allows them to make enough contributions to maintain their funded status. Although statistically significant, the magnitude of these coefficients is small. But the implication of their findings is that actuarial assumptions cannot be used as exogenous variables when assessing the funding status of public pension plans.

In addition to the impact of fiscal stress on pension funding, Chaney et al. (2002) also test whether fiscal stress and balanced budget requirements result in a higher assumed rate of return. They find that states that have balanced budget requirements select higher discount rates during economic downturns, one indication that they divert funds from pensions to other areas. However, fiscal constraint by itself is not associated with higher discount rates, implying that states use pension funds only when they have to balance their budgets. The implications of these findings are limited by the cross-sectional data and the lack of governance variables, which other studies find to be significant predictors of the discount rate.

Eaton and Nofsinger (2004) study the effect of fiscal stress on three types of actuarial assumptions - the assumed rate of return, the wage growth rate, and the amortization period[8] for public pension plans. Their fiscal constraint variables measure interest expenditures per revenue and total debt per revenue. Their analysis is based on a cross-sectional pool of five years of PENDAT observations and uses OLS to estimate the impact of fiscal stress on each one of the assumptions. They find that states with fiscal constraints have higher expected rate of return and longer amortization period, both leading to lower actuarially determined contributions. However, the analysis of the actuarial assumptions controls only for asset allocation but not for governance factors and funding status, so the results are not directly comparable to those of Hsin and Mitchell (1997).

In summary, the studies of the determinants of actuarial assumptions vary significantly in their models and the data that they use, and therefore the findings are not directly comparable. All studies find some impact of fiscal condition on actuarial assumptions of pension plans. However, the extent of the impact and the channels through which actuarial assumptions are

[8] The amortization period is the number of years over which the unfunded pension liability is projected to be paid out. A shorter amortization period would require more contributions.

influenced have not been established in the current literature. It is important to establish that actuarial assumptions are not independent of the fiscal condition of the sponsor and the funding of the pension plan, in order to control for these factors when examining the funding status of pension plans. But it is also important to determine if any pension governance structures alleviate this problem so that it can be potentially addressed by policy makers.

CHAPTER 3: THEORETICAL FRAMEWORK

Agency Theory

Agency theory is used here to examine the governance and the financial management of public pension plans. Governance includes all the mechanisms in place designed to regulate the relationship between pension stakeholders, particularly between the board of trustees on the one hand, and the beneficiaries and taxpayers on the other hand. Agency models present alternative governance structures designed to address problems of incomplete information and goal conflict characteristic of an agency relationship. An agency relationship is defined by Levinthal (1988) as a relationship "between two (or more) parties when one, designated as the agent, acts on behalf of another, designated the principal" (p. 155). The necessity for alternative governance mechanisms arises from two assumptions about the nature of the agent and the principal. First, departing from neoclassical economic assumptions, it is very likely that the principal does not have complete information about both the actions and the characteristics of the agent. These two aspects of incomplete information are also known as "moral hazard" and "adverse selection." Second, it is further assumed that the agent and the principal have conflicting goals (Levinthal, 1988, p.156). Therefore, the principal cannot ensure that the agent is working in the direction of furthering the principal's goals.

Agency models have been used extensively in the context of corporate governance, where shareholders (the principals) delegate all management decision-making to managers (the agents) (Jensen and Meckling, 1976). This separation of ownership from the decision-making may result in inefficient outcomes if agency assumptions of goal conflict and uncertainty are true. As a result, agency models have generated complex compensation packages and contracts in order to mitigate these problems. Two main approaches to dealing with agency problems are

outcome-based contracts and monitoring (Eisenhardt, 1989; Levinthal, 1988). There are trade-offs involved in the use of either one approach based on the costs of measuring the outcomes and costs of monitoring. Outcomes in an agency relationship that are characterized by uncertain cause-effect relationships are more suitable for behavior monitoring controls, because the outcome cannot be attributed solely to the actions of the agent. There also have been extensions to agency models involving repetition of the relationship over time, which is expected to improve efficiency, and compensation based on the performance of other agents (Levinthal, 1988).

Theoretical Model

In order to apply agency theory to public pension plans, we need to identify the stakeholders and their motivations, and to examine whether there are goal conflicts and information uncertainty that could potentially generate agency issues. The analysis here includes the following pension stakeholders: pension members, taxpayers, pension sponsors – state and local governments, and the pension boards of trustees (Hess and Impavido, 2004). Other pension stakeholders include those that provide financial services, such as investment managers and actuaries, but they are not considered formally in the model.

All stakeholders in this model consider trade-offs between choices available to them that impact the funding status of the pension plan. Due to the long-term nature of pensions, these choices always involve trade-offs between some form of current and future consumption. The inherent conflict in pension funding arises from this inter-temporal choice. The principle of intergenerational equity requires that current taxpayers pay for the services that they receive, which would include paying for both the salaries and benefits of public employees. However, since benefit payments are due in the very long-run, decisions about contributions would be

affected by how each stakeholder group discounts events in the future. These trade-offs are discussed for each stakeholder group below.

Pension members (current or retired) are the group who has the most direct stake in the sustainability of public pension plans. First, pension benefits are part of the compensation package of public employees, so they have expectations about that source of retirement income. Also, most public employees, unlike private sector employees, contribute to their defined-benefit plans, so they have a direct stake in those accumulated assets. Finally, about one-third of state and local employers do not participate in the federal Social Security program, so their pension plans are the principal source of retirement income for these employees.[9]

For defined-benefit plans, it is generally assumed that current members may not see any changes in their benefits regardless of plan performance because their benefits are fixed by contract.[10] However, contributions for active members may increase if it is necessary to improve the funding of the plan. Also, the extent to which benefits are protected depends on state law and case law, and whether the pension member is vested in the pension plan.[11] On the other hand, if the plan performs better than expected and becomes overfunded, active and retired members may see an increase in their benefits (for example, through cost-of-living increases or increases in the benefit multiplier).

[9] Among the pension plans in the Public Fund Survey, all employees in 26 plans and some employees in 7 plans were not eligible for Social Security coverage as of fiscal year 2009.

[10] However, state legislation in 2010 has tried to change some of the benefits to current pension members, including cuts in COLAs for retirees and increases in the retirement age. Colorado reduced the 2010 COLA from 3.5% to 0, and limited future COLAs to 2% provided there are no large market losses. South Dakota reduced the 2010 COLA from 3.1% to 2.1% and tied future COLAs to pension funding levels. Minnesota also reduced 2010 COLA and future guaranteed COLAs (Fehr, 2010). All of these proposals are challenged in the courts by employees and retirees.

[11] In some states vesting determines the beginning of the binding contractual relationship between the employer and the employee, therefore benefits can be changed to non-vested employees. Usually, the vesting period is between 5 and 10 years of service.

Public employees decide on trade-offs about pension contributions and benefits. They may bargain collectively about their level of contributions, or may influence contributions indirectly through the investment strategy of the pension board. A riskier investment strategy, with more assets invested in equities, may generate higher investment returns, and therefore lower contributions. However, if public sector employees are risk-averse, they may value more certain outcomes about their benefits and contributions, versus high-return but high-risk outcomes. In fact, it is generally and traditionally assumed that public employees trade-off higher salaries in the private sector for higher benefits and more secure employment in the public sector (Buurman et al., 2009; Murphy and Van Nuys, 1994). To the extent that this is the case, public sector employees can be considered to be more risk-averse than private sector employees. Therefore, pension member trustees do not have a strong inter-temporal mismatch of their incentives and are expected to contribute to stable funding levels.

The case of retired pension members needs to be addressed with several caveats. Retirees face a moral hazard problem if they choose to support a more risky investment strategy. If the plan does not perform well, they have nothing to lose since their benefits have already been determined and they do not make any contributions. But, if the plan exceeds its returns, they may get higher benefits from one-time COLAs, and this scenario appears to have some historical support. The extent of this moral hazard problem is subject to empirical verification for several reasons. First, levels of risk-preferences may vary among individuals, so the aggregate result may be insignificant. Second, retirees may fear that risky exposure may make their pension benefits less secure in the future, as it is currently illustrated by cuts in guaranteed COLAs. In that case, their incentives would be aligned with those of active pension members.

Another stakeholder group for defined-benefit plans are taxpayers, who bear directly the cost of inadequate pension funding with DB plans, or the benefit of overfunding. If pension plans are underfunded, taxpayers may have to make up for the necessary revenue for pension contributions either through higher taxes or less government spending in other areas. If pensions are well-funded or overfunded, taxpayers may see a decrease in their taxes or an increase in other areas of government spending. Taxpayers trade-off the level of taxes that they pay in the current period and the taxes that they will pay in the future to honor the promised benefits.

Rational taxpayers would know that any current underfunding will come at the cost of higher taxes in the future. However, they may discount the future at a very high rate, and therefore shift consumption to the current period. Further, taxpayers may have limited information regarding pension funding, including the actual level of pension funding. As a result, they would be more likely to favor tax reductions (or no tax increases) in the current period because they do not have enough information about the extent of the trade-off involved in the future (Rogoff, 1990; Nordhaus, 1989). One of the main arguments of proponents of market-value reporting of pension obligations is that it would provide better information to taxpayers about the cost of promised benefits, while current accounting and reporting practices may underestimate those (Gold and Latter, 2009).

State and local governments are the third stakeholder group with competing priorities as both employers in the public sector and elected representatives of taxpayers. Particularly, the long-term nature of pension funding competes with the short-term priorities of governments, defined and restricted by the electoral cycle. Generally, it is widely accepted that elected officials are interested in being reelected, whether for opportunistic or ideological reasons (Rogoff, 1990; Nordhaus, 1989). The relationship between voters and elected officials is also

characterized by agency problems associated with incomplete information, modeled as uncertainty about the competence of the elected official. A signaling mechanism regarding competence is how well the elected official understands and manages the budget. If the elected official is able to increase spending without increasing taxes, this is considered a signal of high competence because the official essentially can do more with less. Under this scenario, if there is a trade-off between current and future consumption, where the impact on future consumption is difficult to observe or estimate (incomplete information), the elected official has an incentive to shift consumption from the future to the current period in order to be reelected.

The presence of what Rogoff terms "a budget cycle" would lead to consistent underfunding of pension systems in election years and better funding during non-election years. But this cycle is further worsened by fiscal shocks that do not allow the sponsor to increase pension contributions due to significant contractions in the economy and local budgets. On the other hand, when pension plans become overfunded, as has been the case during the exceptional investment returns during the 1990s, elected officials are presented with a set of incentives that match their short-term goals though both undermine the sustainability of pension plans. When plans are overfunded, politicians can please both their employees and their constituents by increasing benefits, reducing contributions and also reducing taxes. Cyclical adjustments in the other direction are precluded by opposition to higher taxes and the strong protection of promised benefits.

Given the incentive structure of the different stakeholders and the nature of defined-benefit plans, it can be seen that the risk of poor performance in these plans is shared by plan members and taxpayers (Hess and Impavido, 2004). However, these groups face a free-rider problem in the monitoring of pension plans due to their large numbers (Besley and Prat, 2003).

The cost of monitoring to each individual is very high, while the benefits accrue to everyone. As a result, in the US, the majority of state and local pension plans are governed by a board of trustees who have a very active management role, encompassing investment policy and asset allocation, actuarial assumptions, and some role in benefit determination (although usually benefits need to be approved by the legislature). Trustees are selected in three ways, as determined by the statute establishing the pension system. Some are appointed by the governor or legislative body, or serve as part of their job (ex-officio), from here on referred to as political trustees. The remaining trustees may be plan members, both active and retired, who can be elected by plan participants or appointed by the governor or legislature, but are trustees by virtue of primarily being plan members. The trustees are the agents for both pension members and taxpayers, in place to ensure the sustainable management of the pension plan.

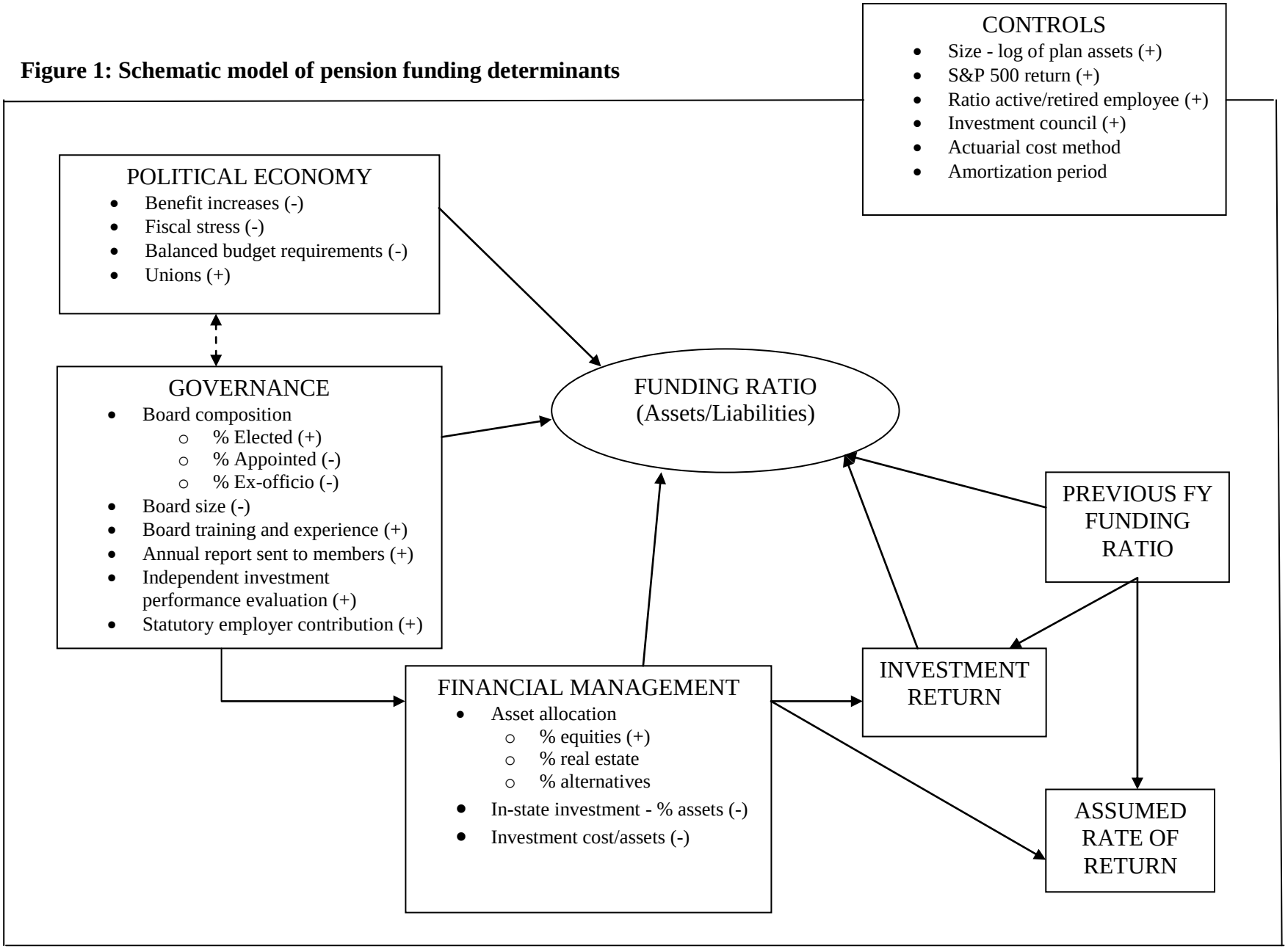
It is assumed that trustees who are plan members have interests that are aligned with those of the other plan members. Their goal is to ensure the long-term sustainability of the pension plan through full funding and a prudent investment strategy. They have an incentive to ensure that employers make the full required contributions to the plan. They also have an incentive to design an investment strategy that is most appropriate given the characteristics of the particular pension plan and maximizes the potential investment returns. They bear directly the consequences of their decisions as pension members, and furthermore, those who are elected have an additional reputation incentive.

Political trustees, however, have a different set of incentives. Since they are not plan members, they do not bear directly any risk from the poor performance of the plan. They may be motivated by external rewards, such as reputation effects and personal career concerns. Since there is no market for board trustees, the influence of such incentives is through political

rewards. Therefore, appointed or ex-officio trustees may be subject to political pressure to make management decisions that would either lower the employer contribution, or use pension funds for purposes that do not necessarily maximize the retirement security of plan members. Although the trustee institution establishes a fiduciary responsibility to manage the pension assets in the best interest of pension beneficiaries following prudent person guidelines, it is not clear to what extent these are binding in practice. Reputation stakes may mitigate somewhat the agency problems arising in this situation, but the careers of political trustees depend more heavily on their reputation within political circles. However, reputation effects may be stronger for ex-officio trustees who may be in elected offices, and therefore, they may care about the impact of their decisions on the electorate.

The next section focuses on the specific hypothesized relationships explored in this study. The schematic model in Figure 1 illustrates the key hypothesized relationships and lists the main dependent and independent variables.

Figure 1: Schematic model of pension funding determinants



Hypotheses

This section discusses in more detail the key hypothesized relationships, which will be tested empirically in the next section. The first set of hypotheses focuses on the set of governance variables. It is followed by hypotheses about the impact of the financial management variables, political variables, and the controlling variables.

H_{1A}: Political trustees are expected to be associated with lower pension funding and lower investment returns.

H_{1B}: Trustees who are plan members are expected to be associated with higher funding ratios and higher investment return.

Following the implications of potential agency problems, board members who are political appointees are expected to be influenced by political pressures, and the decisions they make may be suboptimal for the performance of the system. They may manipulate the actuarial assumptions in order to decrease the employer contributions to the pension system and thus undermine the long-term funding of the system. Or, they may engage in targeted investments at the state/local level with higher risk but not commensurate compensation for this risk in terms of return. Hess (2005) finds a positive impact of appointed trustees on investment return, while Romano (1993) finds a negative impact of appointed and ex-officio trustees on investment return.

On the other hand, board members who are plan members are expected to have their interests aligned with those of beneficiaries. Plan members bear directly the results of pension plan performance through changes in their contributions or benefits, and they are not subject to the same type and extent of political pressure that political appointees would be, given their election by plan members. Therefore, it is expected that a board made up of a higher proportion

of plan members should advance pension fund performance. Harper (2008), Hsin and Mitchell (1997) find the expected positive relationship, while Yang and Mitchell (2005) find a negative impact of pension members on funding levels.

There is an ongoing debate about the expected effect of having ex-officio board members. On the one hand, they are perceived equal to political appointees and expected to be subject to the same agency problems. On the other hand, it is argued that ex-officio trustees often have high reputation stakes involved because of their prominent positions. Therefore, they will try to avoid negative publicity by ensuring the successful management and performance of the pension system. In this study, ex-officio status is measured as appointment to the board of trustees as a result of holding a government office such as a chief financial officer. In line with agency theory, we are positing a negative relationship between ex-officio trustees and pension performance.

H_2: Training and expertise in financial management is expected to be associated with higher investment return and pension funding levels.

Elected plan members to public pension boards may not and usually do not have the necessary knowledge and/or experience to understand complex investment decisions or control investment managers adequately. Appointed trustees who are required to possess substantive knowledge and experience in financial management can be expected to make better investment decisions and therefore generate higher returns on investment. In the model above, we control for financial management experience and knowledge by including a dummy variable indicating whether experience or education are required for appointment to the board of directors. This variable is interacted with the variable for the elected and appointed trustees.

Given the available information about expertise requirements, it may be difficult to account for the complete impact of pension expertise. Controlling for experience and knowledge may account for differences in performance where there is an explicit statutory requirement. However, if such experience is not required but is nevertheless present, it may be difficult to differentiate between the effect of experience (which is expected to be positive) and the effect of political pressure (expected to be negative) on performance.

H_3: Information controls in the form of independent investment performance evaluations and annual reports sent to all members are expected to improve the performance of the pension system.

The external evaluations compare the investment performance of the pension fund to similar funds and provide recommendations for improving performance. Most of these are done at least annually, and a large number are done quarterly, but the variable used in this study does not control for frequency. The investment performance report itself provides information to stakeholders that can be used to control potential agency problems. It is not clear exactly the mechanism through which independent investment performance evaluations work, but Useem and Mitchell (2000) find that they only have an indirect impact on investment through the investment strategies that are selected by the board. This implies that the information is used by the board of trustees.

Pension systems are required to put together a comprehensive annual financial report (CAFR) and provide it to employers and the legislature. The annual report includes sections about investments, actuarial assumption, and financial performance. Most of the systems now have their annual reports on their websites, but it is not clear to what extent pension plan members utilize those. It is argued here that if reports are sent automatically to plan members, as

part of the newsletters from the pension system, the information revealed in the reports will serve as a monitoring tool. Hess (2005) finds a negative impact of annual reports on investment returns, while Yang and Mitchell (2005) find a positive impact.

H_4: A statutory contribution rate is expected to be associated with higher and more stable funding ratios.

The model includes an indicator variable for the funding policy of the pension plan. The two most common approaches to determining the employer contribution include (1) that based on actuarial assumptions and (2) that set by legislation (statutory rate) (Peng, 2009). The statutory rate is based on the actuarial assumptions of the pension plan, but it is designed to create a stable contribution rate for the government or correct for underfunding (Peng, 2009). It does not vary every year with the change of actuarial assumptions and it may be above or below the actuarial contribution rate for a particular year, but it is adjusted to reflect actuarial experiences over the long run. It can be argued that the statutory contribution rate is not as easy to manipulate because changes require legislative action that may be more visible than changes in the actuarial contribution rate made by the pension board. Therefore, we can expect that a statutory rate represents commitment to plan funding and would be associated with more stable funding.

H_5: Investment return is expected to be strongly and positively related to the funding of the pension system.

One of the main rationales for prefunding pension plans is that the accumulated assets can earn an investment return and employers can rely on this source of asset growth to fund their pension plans in the long run, in addition to their contributions. Investment returns have become a significant driver of funding levels after pension systems expanded their equity investments.

This has been illustrated by the significant improvement in funding ratios for most pension plans during the 1990s, when their equity holdings increased and the stock market was generating very high returns (Young and Mitchell, 2005).

One channel through which the governance factors discussed above affect the funding ratio is through the financial management decisions of trustees. Those financial management decisions in turn determine the investment return for the pension assets. The model considers both asset allocation choices and the percent of assets invested in-state.

H_6: In-state investments are expected to be associated with lower investment return.

This will be true to that extent that politically-motivated, in-state investments, also known as targeted investments, may trade off return to state and local retirees for political gains from socially desirable projects. Some pension funds have explicit requirements that any in-state investments have comparable risk-return profiles to any other investment. The empirical evidence about the impact of in-state investments so far has been mixed (Hess, 2005; Coronado, 2003; Romano, 1993). Romano discusses in great detail examples of political pressure exerted on pension funds about investments, California and New York are among the most prominent examples (Romano, 1993; p.802-804). She finds marginally significant negative impact of statutorily required targeted investments on pension investment returns. Coronado (2003) and Hess (2005) do not find any impact of ETIs on investment return. Both studies note problems with measuring the extent of ETI investments, because some states that engage in ETI investments do not report these, either because they do not consider them targeted or due to their perceived negative effect.

H_7: Investments in stocks are expected to improve investment return.

These are high-risk, high-return investments that have historically produced higher returns than fixed-income investments and have been found to have a positive effect on investment returns in earlier studies (Useem and Mitchell, 2000; Coronado et al., 2003; Hess, 2005). The high average return is associated with higher volatility during financial downturns, so the impact of equities over this relatively short period of time may be influenced by the extremely large stock market losses. The variable measures the percent of assets allocated to domestic and international equities.

The next set of hypotheses discusses the expected impact of the political variables, including fiscal stress, the presence of unions, and legislative benefit increases.

H_8: Fiscal stress and balanced budget requirements (BBRs) at the state level are expected to lead to lower funding levels of pension plans.

Fiscal stress is an important factor to consider for pension funding because funding decisions do not exist in a vacuum for public pensions. They are part of a larger question about how to distribute the available resources given certain constraints. Pension contributions have to come from the general fund and they compete with other pressing priorities and balanced budget requirements. During a poor economy that results in lower revenues, states may redirect part of their pension spending to other areas. They may do that directly, by reducing the contribution to the pension plan, or they may do it indirectly by influencing how the contribution to the pension plan is calculated.

Both anecdotal accounts and previous studies indicate that political trustees are pressured to change actuarial assumptions in order to decrease pension contributions during tough economic times (Chaney et al., 2002; Eaton and Nofsinger, 2004; Hsin and Mitchell, 1997). More often than not, this is done by increasing or maintaining an unreasonably high assumed rate

of return, which is also used as the discount rate for the pension liabilities. The effect of a small change in actuarial assumptions would have a significant effect on the required pension contribution. Analysts point out that a 2-percentage point variation around an interest rate of 7 percent can lower costs as much as 40 percent or increase costs as much as 60 percent (VanDerhei, 1994). Therefore, a small increase in the assumed investment return would result in a significant reduction in pension contributions, and consequently reduce the funding level of the pension plan. Alternatively, trustees may change a combination of actuarial assumptions, including projected wage growth and demographic assumptions, but the individual impact of each of these is smaller than the impact of the discount rate.

Additionally, if the state is required to balance the budget at the end of the fiscal year, in a down economy, budget and policy makers may use pension funds to meet that requirement (Chaney et al., 2002, Hsin and Mitchell, 1997). Therefore, we have included an interaction term between fiscal stress and balanced budget requirements. We expect that not only will states under fiscal stress underfund their pensions, but that this practice will be even more significant in states with balanced budget requirements.

H_9: A higher number of unionized public employees is expected to be associated with higher funding levels.

Unions are better able to inform and organize their members and therefore, they are better able to monitor the decisions of the pension board and the legislature. However, it is not clear to what extent unions may trade-off future pension funding for current higher wages or benefits for their members. That is, unions may be willing to tolerate underfunding as long as they are assured that some of the money goes for higher wages. Although this is a possibility, historical evidence suggests that negotiations have involved trading-off salary increases for more pension

benefits. Few of the earlier studies examine the impact of unions, but Chaney et al. (2002) find a positive impact of state employees' union membership on pension funding. The presence of unions is measured by the percent of public employees who are covered by a collective bargaining agreement in the state.

H10: Legislative benefit increases are expected to lead to lower pension funding levels.

If benefit increases are accounted for appropriately and planned, they do not have to result in lower funding ratios. However, the evidence from the late 1990s and early 2000s suggests that benefit increases were granted in response to high investment returns but may not have been financed properly for all pension systems. The main reason for this is that benefit increases are usually applied to all employees and many have not made contributions that would be necessary to finance the new benefits. Therefore, benefit increases are expected to result in lower funding ratios. Benefit increases are measured by a variable indicating whether the legislature approved benefit enhancements in that fiscal year.

CHAPTER 4: DATA AND RESEARCH METHODOLOGY

Data Sources

The analyses conducted here use a new and unique dataset for fiscal years 2000 through 2009. The new dataset is a combination of two existing datasets – the Public Fund Survey (PFS) and PENDAT, as well as governance and financial management data collected for the purposes of the current research, and also state government statistics. The PFS follows 100 major pension systems and their pension plans (usually state and teachers plans are the largest within a system). PFS data are publicly available from the National Association of State Retirement Administrators (NASRA) starting in fiscal year 2001. According to the US Census Bureau (2010), the total number of pension systems in 2008 was 2,550; 218 of these are state pension systems and the remaining 2,332 are local systems. The pension systems in the PFS constitute about 85 percent of the total pension systems in the United States in terms of both membership and assets.

System-level data in the PFS include asset allocation, investment return (current year and three-year and five-year averages), contributions, benefit payments, and the total number of system members. Plan data consist of information about the actuarial assumptions for the specific plan, including the assumed rate of return, actuarial cost method, and amortization period. Also, the dataset contains all the benefit parameters for each plan, the actuarial assets and liabilities, and the employer and employee contribution rates for each plan.

The PENDAT survey was a longitudinal survey of public pension systems conducted in the 1990s through 2000, for a total of seven years. In addition to financial data, the PENDAT survey collected self-reported information about pension governance and financial management. The last year of the PENDAT survey, fiscal year 2000, is used as a baseline for the governance

data necessary for this research. Unlike the PFS that collects information from annual reports and other published materials, as well as email follow-ups with pension system managers, the PENDAT is a survey with self-reported data and the response rate and participating systems vary each year. The PFS attempts to continue the collection of public information about state and local pension systems, but does not rely on survey responses. Instead, it follows the same pension systems over time but with a limited focus on financial variables and benefit parameters.

The overlap between the PENDAT in 2000 and the systems in the PFS is 72 systems, i.e. baseline governance data is available for 72 of the systems in the PFS. The remaining information, including baseline governance and financial data for FY 2000 for the systems that were not in PENDAT (28 systems), the latest governance data for FY 2009, state statistics on fiscal stress, balanced budget requirements, and other controls were collected through several different efforts. First, all pension systems were surveyed through an electronic survey and a follow-up paper survey to non-respondents (survey questionnaire in Appendix 2) in the spring and summer of 2010. The survey questions were focused on the current governance and financial management practices, as well as benefit increases over the past decade (2000-2009). The survey was reviewed by Keith Brainard, Research Director at NASRA, who coordinates the PFS. After his feedback, the survey was sent to all pension systems that participate in the PFS. The combined response rate for the electronic and follow-up mailed survey was a total of 44 systems out of 100.

Second, governance and financial management data for the remaining systems was collected jointly with a trained graduate student. The trained student was funded by a Georgia State University dissertation grant and was able to work for a total of 50 hours, completing data collection for about 20 pension systems. The data collected by the graduate student were cross-

checked against survey responses and the pension systems websites. All of the information was collected from pension systems comprehensive annual reports (CAFRs), state pension statutes, and pension system websites. After all baseline information (2000) and latest published information (2009) was collected, those systems that did not have any changes in the governance and financial management rules were considered complete for the years in between. For those systems indicating a change from the collected data in 2000 and 2009, additional data was searched through pension websites and earlier CAFRs; also, follow-up with pension system contacts was conducted, both by email and telephone. In total, about half of the systems' administrators were contacted for follow-up on various continuous variables such as benefit increases over the decade, or other variables such as training and expertise requirements – all variables that were not included in the original PENDAT survey, but which are important for the current study. The response rate for the follow-up was about one-third of the systems that were contacted.

The total number of pension systems included in the dataset for this research is 100; 80 state and 20 local pension systems. Some state pension systems have more than one pension plan, so the unit of analysis is the pension plan, with two pension plans from the same system having the same board structure but different plan characteristics. Further, assets are accounted separately actuarially, so there are separate funding ratios for each plan, and actuarial assumptions may be different. The total number of plans considered here is 124, with 104 state plans and 20 local plans.

State-level variables were collected from several sources. Data about union membership was collected from Unionstats.com, a database compiled from the CPS by Barry Hirsch and David Macpherson (2011). The dataset contains annual statistics about public employees

covered by collective bargaining contracts by state. Financial data about the fiscal stress variables was collected from the US Census Bureau, including state revenues, debt, population, as well as annual bond ratings by state (US Census Bureau, 2000-2011). Data about year-end general fund balances is available from the National Association of State Budget Officers (NASBO). Data about balanced budget requirements was also obtained from NASBO. NASBO collects data about different types of balanced budget requirements, which is published in the periodic reports "Budget Processes of the States" (NASBO, 2002; 2008).

Estimation Methodology

The regressions in this study examine the determinants of pension fund performance using a longitudinal framework. This is the only study known at this point that estimates jointly the impact of the independent variables on funding levels, investment return, and actuarial assumptions. The dependent variables are the funding ratio (the ratio of assets to liabilities) and investment return. The funding ratio provides a long-term perspective on the sustainability of the pension plan, while the investment return focuses on the short-term implications of financial decisions. This analysis also examines whether the assumed rate of investment return is manipulated in response to economic conditions.

The econometric specifications for each of the equations are as follows:

$$\text{FundingRatio}_{i,t} = \alpha_i + \beta_1\text{FundingRatio}_{i,t-1} + \beta_2\text{InvestmentReturn}_{i,t} + \beta_3\text{Governance}_{i,t} + \beta_4\text{Management}_{i,t} + \beta_5\text{Political}_{i,t} + \beta_6 X_{i,t} + \varepsilon_{i,t}$$

$$\text{InvestmentReturn}_{i,t} = \alpha_i + \beta_1\text{FundingRatio}_{i,t} + \beta_2\text{FundingRatio}_{i,t-1} + \beta_3\text{Governance}_{i,t} + \beta_4\text{Management}_{i,t} + \beta_5 X_{i,t} + \varepsilon_{i,t}$$

$$\text{AssumedRate}_{i,t} = \alpha_i + \beta_1\text{FundingRatio}_{i,t} + \beta_2\text{FundingRatio}_{i,t-1} + \beta_3\text{Governance}_{i,t}$$

$$+ \beta_4 \text{Management}_{i,t} + \beta_5 \text{Political}_{i,t} + \beta_6 X_{i,t} + \varepsilon_{i,t}$$

Each of the dependent variables is determined by a set of governance and financial management factors, and the funding ratio and the assumed rate of return are expected to be influenced by political and economic factors as well. Additionally, the lagged funding ratio is expected to influence all three dependent variables. X_{it} includes control variables such as the S&P 500 annual return for investment return and actuarial practices for the pension funding ratio. The error term $\varepsilon_{i,t}$ consists of two elements, one is a time-invariant system-specific disturbance term, μ_i, and the other one is a random disturbance term, υ_{it}, assumed to be serially uncorrelated.

$$\varepsilon_{i,t} = \mu_i + \upsilon_{it}$$

A panel dataset provides opportunities to deal with estimation problems that cannot be addressed in regular cross-section analysis. Specifically, there are more opportunities to address endogeneity problems arising from several potential sources. The first problem arising from the specification of the equations above is the potential endogeneity of the lagged funding ratio, because the lagged funding ratio may be correlated with the system-specific error term.

The second problem arises from the simultaneous determination of the set of dependent variables in the equations above. Therefore, the independent variables will be correlated with the error term and the coefficients will be biased. Other studies have explored the simultaneous nature of funding levels and investment return, because investment return impacts funding levels through the assets (Yang and Mitchell, 2005; Harper, 2008). However, if the assumed rate of

return is determined strategically in response to economic conditions, then it is also determined at the same time as the funding level, because it impacts it through the actuarial liabilities of the pension plan.

A third potential issue that has not been explored in the literature previously is endogeneity due to unobserved heterogeneity. Specifically, it is possible that there are system-specific characteristics that are not measured by the available variables, which may be correlated with some of the independent variables. For example, the risk preferences of trustees may impact investment return through asset allocation and investment management. However, this analysis does not have any individual level data about the board of trustees and is not able to control for such factors. System-specific characteristics may be fixed or random depending on whether they stem from individual characteristics or organizational characteristics.

Finally, the dataset that is available for this analysis may create endogeneity issues due to the short time dimension compared to the number of systems and plans (T=10, N=120). With this type of dataset, short-term shocks that are unobservable can influence the results without enough time to disperse.

Considering the potential endogeneity issues that may be present in the regressions above, there are two estimation methods that are most appropriate in these circumstances. The first one is the Arellano-Bond estimator (1991), and the second is Three Stage Least Squares regression (3SLS) (Wooldridge, 2002).

Arellano-Bond Estimator

The Arellano-Bond estimator is a fixed-effects, first-difference, instrumental variable estimator. It addresses the fixed effects bias by differencing each equation. As a result, there is no longer correlation between the fixed effect μ_i and the lagged funding ratio. However, the

lagged variable is correlated with the lag of the random disturbance in the differenced equation, $\upsilon_{i,t-1}$. To eliminate the resulting bias, Arellano-Bond uses longer lags as instruments for all endogenous variables, including the lagged dependent variable and other weakly exogenous variables in the model. The advantage of the Arellano-Bond estimator is that it is robust and it uses existing data to instrument for endogenous variables, instead of external instruments that may perform poorly. The Arellano-Bond estimator is used in many economic and budget studies with lagged dependent variables as regressors (see Noonan (2007) for a discussion of state arts agencies appropriations).

There are two types of Arellano-Bond estimators, the Difference GMM and the System GMM. The Difference GMM uses only the differenced equation and lagged levels of the dependent and independent variables to estimate the regression coefficients for the endogenous variables. Differences of the strictly exogenous variables are instruments for themselves. The System GMM augments the Difference GMM by adding a second equation in levels to the equation in differences, and instrumenting for the endogenous variables in that equation with lagged differences of the variables. System GMM can improve on the efficiency of the Difference estimator because it provides more instruments. However, it relies on the assumption that the first differences of the instruments are not correlated with the fixed effects in the panel. It may also be inefficient with a relatively small number of observations because of the large number of instruments that it creates (Roodman, 2006).

However, the Arellano-Bond procedure cannot estimate the impact of time-invariant variables on the level of the dependent variable because the time-invariant variables are differenced out. The governance variables do not change for most of the pension systems over such a relatively short period of time. Although there are some systems that have governance

and actuarial changes during that period, it may be difficult to estimate the coefficients for these variables. The System GMM estimator can estimate the coefficients from the equation in levels by taking into account only the correlation among the coefficients in that equation and not the differenced equation.

Although Arellano-Bond estimators have some drawbacks considering the hypotheses that need to be tested in this study, they can provide an indication of what instruments are most appropriate for some of the endogenous variables. Specifically, the regression results can indicate the most optimal lag structure for the endogenous variables, which then can be replicated in Three-Stage Least Squares (3SLS).

Three-Stage Least Squares

Three-Stage Least Squares (3SLS) can estimate a system of equations that have endogenous variables due to simultaneity. The 3SLS estimator is a combination of Two-Stage Least Squares (2SLS) instrumental variable regressions for each equation, but it allows the error terms across a system of equations to be correlated. This provides more efficient estimation of the coefficients if the equations are correctly specified (Wooldridge, 2002). If there is misspecification in one of the equations, it affects the entire system, making the coefficients inconsistent. 3SLS requires the specification of the instrument matrix, with the standard requirements that the instruments should be strongly correlated to the endogenous variable that they are instrumenting for and not correlated with the dependent variable.

Three-Stage Least Squares is also a more efficient estimator than Arellano-Bond because it does not have to use previous years of observations from the dataset to obtain the instruments. However, it requires that the dataset have enough external variables that can be used as instruments in each equation. Alternatively, one can apply the Arelleno-Bond logic to 3SLS and

include lagged values of the endogenous variables as instruments. In a 2SLS framework, the instruments include all exogenous variables, which instrument for themselves, as well as the additional excluded instruments for the endogenous variables.

The complete set of exogenous instruments in the three equations includes the governance, financial management, and political variables and the set of controls for each equation. In order to achieve identification, it is necessary to have enough exogenous variables in each equation to be used as instruments that do not appear in the other two equations. In the 3SLS estimation, the endogenous variables are the three dependent variables – the funding ratio, investment return, and the assumed rate of return. The excluded instruments for the funding ratio include the statutory required contribution, which does not appear in the other two equations, as well as the added instrumental variables active ratio, amortization period, and entry age actuarial method. The instruments for the investment return include S&P500, plan size, investment expense, and the added instrumental variable investment council.

All variables for the 3SLS estimation are first-differenced in order to remove the plan-specific fixed effects. The coefficients from the regressions, therefore, are the changes in the dependent variables in response to changes in the independent variables.

CHAPTER 5: EMPIRICAL RESULTS

Dependent Variables

All variables used in the empirical analysis here are listed and described briefly in Appendix 3. The dependent variables are the funding ratio of the pension system, the annual investment return, and the assumed rate of return. The funding ratio is calculated by dividing the actuarial assets of the pension system for a given fiscal year by the actuarial accrued liabilities (AAL). Both of these variables are available at the plan level. Ideally, it is preferable to use the market value of assets and a common measure of the actuarial liabilities in order to have comparable funding ratios. However, the market value of assets is available as a variable only at the system level and is not disaggregated by plan. Also, the market value of assets is not available for all years in the dataset, so using it will result in the loss of many observations. Actuarial liabilities are not comparable directly because they depend on the assumed rate of return and the actuarial cost method, which distributes liabilities over time. In order to take into account these factors and recalculate liabilities, it is necessary to have all the actuarial data for each pension plan.

Investment return measures the short-term performance of the pension system and is also a key determinant of the funding status of a pension plan. Investment return is measured as the current year return on the invested pension assets (gain or loss) divided by the assets. The assumed rate of return is actuarially determined and it provides an estimation of the average investment return in the future over a long period of time. It is also used as the discount rate for calculating the actuarial liabilities of the pension plan. The assumed rate of return should be mostly determined by the asset allocation of the plan's assets and the long-run return of each asset class.

Independent Variables

The first set of independent variables includes governance indicators expected to influence all three dependent variables. They include board composition, board size, required training and experience of board members, annual report sent to members, and whether the pension contribution is set statutorily. Board composition variables indicate the percent of board trustees who are elected by plan members, appointed by the executive, or serving ex-officio. All of these variables are scaled by board size due to the significant variation in board size. Board size is a continuous variable indicating the total number of board trustees.

There are two variables that measure the experience and training of pension trustees. The first variable focuses on experience and education, and it is coded 1 if at least one board trustee is required to have financial management experience in order to serve on the board. It is also coded 1 if board trustees serve on the board ex-officio in a position that requires financial management experience, such as Treasurer, Comptroller, and Chief Financial Officer. The other binary variable indicates whether trustees are required to undergo training in financial management and investments as part of their service on the board. It is also coded 1 if pension systems indicated that they offer training to their trustees, although it may not be required by statute.

Previous studies (Romano, 1993; Hess, 2005; Yang and Mitchell, 2005) include automatic reports sent to all members and independent investment performance evaluations as possible information controls aimed at reducing agency problems. These two variables are binary indicators, taking the value 1 if the practice exists for the pension system, and 0 if not. Most pension systems have their annual reports available on their websites, but this is considered a weak disclosure because it assumes that people will look it up and read it. Therefore, the

variable for annual report is coded 1 if a summary of the report is sent to pension members as part of the communications with them. Also, most pension systems indicated in their survey responses that they perform at least annual investment performance evaluations, and a significant number perform quarterly evaluations. This variable was harder to code from websites and statutes for the systems that did not respond to the survey because such a requirement was not mentioned explicitly in their statutes. However, some pension system websites had summaries of the investment evaluation in the investment section of their websites.

Another governance feature that may have an impact on pension funding and investment return is the prudent person or prudent investor standard. According to this standard, pension trustees undertake the responsibility to manage the pension system as would a prudent person and in the best interest of plan beneficiaries. The following is an excerpt from the Missouri Revised Statutes and is generally representative of the wording in most state statutes:

> "An investment fiduciary shall discharge his or her duties in the interests of the participants in the system and their beneficiaries and shall: 1) Act with the same care, skill, prudence, and diligence under the circumstances then prevailing that a prudent person acting in a similar capacity and familiar with those matters would use in the conduct of a similar enterprise with similar aims." (Missouri Statutes, Section 105.688, 2008)

It is expected that the presence of a prudent person standard may prevent political influence on board investment decisions by holding trustees accountable to this standard. However, earlier studies have not found a significant impact for this variable.

Finally, this research tests whether a specified statutory contribution rate has any effect on pension funding status. This is also a binary variable, taking the value 1 when the statute requires that the employer contribution should be a certain percent of payroll each year. The main advantage of a statutory contribution rate is that it does not change with the funding ratio

and employer contributions fluctuate less as a result. The other advantage, particularly relevant for the funding status of the system, is that during periods of overfunding the employer continues to make contributions which build up the assets of the system, while during economic downturns, the employer can rely on the excess assets to make up for investment losses (Peng: p. 173, 2009). Alternatively, the employer contributions are set actuarially each year depending on the funding levels of the plan. A statutory contribution rate also provides less motivation for manipulating the assumed actuarial rate of return because it is not used each year in the calculation of the required employer contribution.

The set of financial management variables provides information about financial management practices of the pension board. Most pension boards have authority over investments, which consists most importantly of asset allocation. Since asset allocation is a major predictor of investment returns, the percent of assets invested in equities is included as an important determinant of investment return. The other two asset allocation variables are the percent of assets invested in real estate and alternative investments, which have been associated with high investment returns, but also with significant losses in 2008 for real estate investments. The other investment practice included in this analysis includes the percent of assets invested in the state. It is expected that plans subject to political pressure would engage in suboptimal investment practices (from the point of view of pension members) such as in-state investments. However, many plans indicated that they did not have any targeted in-state investments in their asset allocation, so this variable has a few state systems with a small percent of in-state investments. Investment expenses are included as a control variable, scaled by total system assets.

The political variables control for factors external to the pension plans that may influence pension funding either directly on their own or indirectly through the board composition variables. The first political variable indicates any discretionary benefit increases approved during the fiscal year. This is a binary variable and includes all types of benefit increases, such as cost of living adjustments, changes in the benefit multiplier, and other benefit enhancements. This variable measures benefit changes approved by the legislature and therefore, it is included in the political variables, rather than plan-related variables. Most of the benefit increases were prevalent in the late 1990s and early 2000s, but many systems had cost of living increases approved by the legislature throughout the period in this study. Since most benefit increases were granted in response to higher funding ratios in the late 1990s and early 2000s, this variable is most likely endogenous. It also needs to be lagged for one period because the impact of the current year benefit increase would be reflected in the next year's actuarial evaluation of liabilities.

The other direct political variable controls for another way that public employees can influence decisions about their pensions – through their unions. This variable measures the percent of public employees in the state that are covered by a collective bargaining agreement. Employees who are union members may have more information about the impact of deferral of pension contributions and in this way directly influence political decisions about pension contributions. On the other hand, it is not clear to what extent unions may trade-off future pension funding for current higher wages or benefits for their members. That is, unions may be willing to tolerate underfunding as long as they are assured that some of the money goes for higher wages. Although this is a possibility, historical evidence suggests that negotiations have involved trading-off salary increases for more pension benefits.

The other political economy variables measure the impact of economic conditions in the state on pension funding. These include a set of financial variables measuring fiscal stress because there is not one most accurate measure of fiscal stress. This is because fiscal stress is a multidimensional concept and it is difficult to measure it with the available financial data about the states (Jimenez, 2009; Rubin and Willoughby, 2009; Chaney et al., 2002; Alm et al., 1993). One of the more frequently used variables in studies about fiscal stress is the year-end unreserved budget balance (general fund balance and budget stabilization fund) scaled by general fund expenditures. Generally, the higher the available balance, the less fiscal stress the state is experiencing. Another variable is the change in state revenues, excluding intergovernmental transfers. Declining own-source revenues indicate that the state is in fiscal stress. A third variable is state debt per capita at the end of the fiscal year. Finally, bond ratings provide a measure of a state's credit standing and an indication of the costs of borrowing. The variable in this study is based on Moody's bond ratings, which are translated into a categorical variable ranging from 1 to 8. The lowest state bond rating over the period in the study is Baa1, which is set equal to 1, and the highest is Aaa, equal to 8. Higher ratings are expected to be associated with higher funding levels.

Furthermore, it has been argued that states with balanced budget requirements may employ a variety of strategies to close budget gaps during difficult fiscal times (Rubin and Willoughby, 2009; Chaney et al., 2002). Among these may be accounting strategies, such as diverting funds from the pension systems. Therefore, it is necessary to control for balanced budget requirements together with the fiscal stress variables. Balanced budget requirements are represented as a binary variable indicating whether the state is required to have a balanced budget at the end of the fiscal year, which is one of the more stringent requirements.

We also control for persistence of funding decisions over time by including a lagged variable for the funding ratio for the previous fiscal year. Actuarial funding ratios reflect the accumulation of funding practices over a long period of time and the lagged dependent variable captures the effect of such accumulation. Furthermore, the lagged funding ratio is also expected to influence investment return and the assumed rate of return. Underfunded plans may decide to undertake more risky investments in order to make up for the lower contribution levels. On the other hand, well-funded plans may also undertake risky investments because they have enough assets to cushion against market losses. Therefore, the impact of the past funded status on investment return is ambiguous. On the other hand, agency theory predicts that underfunded pension plans may resort to manipulations of the assumed rate of return in order to hide some of their underfunding.

Since there is large variability in the size of the pension systems, even though the systems in the Public Fund Survey are the largest pension systems, we include the natural log of plan assets as a control. The S&P 500 annual return controls for the overall performance of the stock market, which is a significant determinant of investment returns because of the large percent of pension assets invested in equities.

There are several additional variables that are used as controls, but most importantly are tested as potential instrumental variables for the 3SLS equations. These include whether the pension system has a separate board for investment management, usually known as an investment council, but also may be a state agency responsible for both asset allocation and investment management. Usually these boards consist of investment professionals and it is expected that they will be associated with higher investment returns (Munnell et al., 2010). However, more specific information about this type of board structure is not available in the

dataset, so it is not possible to test more specific hypotheses about this alternative governance structure.

Another control variable is the ratio of active to retired pension plan members. This ratio indicates whether the plan is relatively new (with more active members) or mature (with a relatively high number of beneficiaries). This variable is important for pension funding in several ways. One is that if this ratio is fairly low, the plan assets need to be invested in more liquid and secure investments, which generally would have lower returns. Also, assets do not have as many years to compound their returns. Therefore, a low ratio of active to retired members may be associated with lower funding levels.

The other two variables control for actuarial practices that may influence the funding level of the plan. The first one is the number years that the plan needs to pay off the unfunded actuarial accrued liability, which is the amortization period for the pension plan. The longer the amortization period, the lower the pension funding levels are expected to be. The other actuarial variable is the choice of actuarial cost method, which assigns how the liabilities are distributed over the period of funding the plan. The Entry Age cost method recognizes a larger portion of the liabilities earlier in the period, so it requires higher contributions earlier and therefore prefunds the plan more than other methods (Munnell et al, 2010; McElhaney, 2009). This variable is coded 1 if the actuarial cost method is Entry Age Normal, and 0 otherwise.

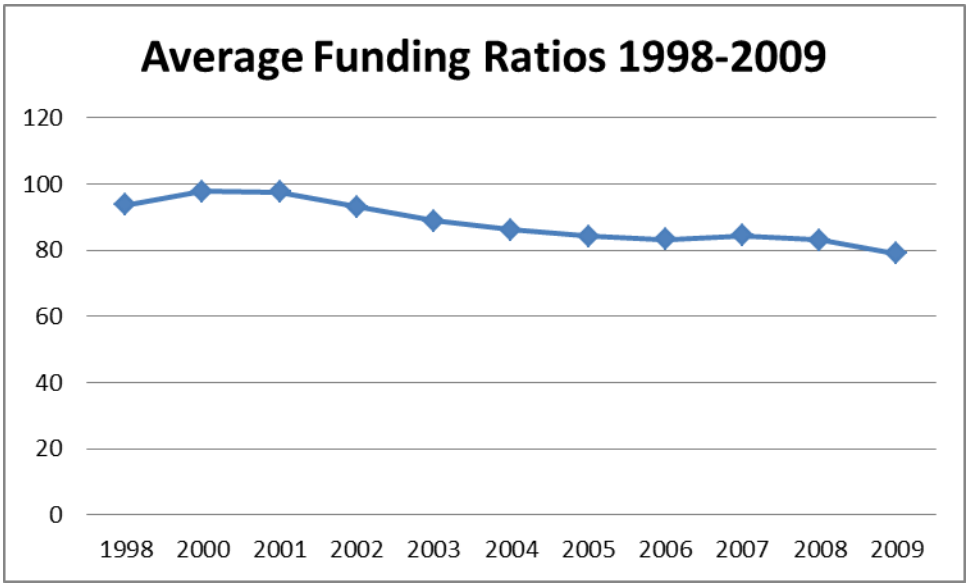
Descriptive Results

The summary statistics for the key variables in the dataset are summarized in Table 1. The total number of cross-sectional observations in the dataset is 124 pension plans. Most of the plans are generally followed for a period of ten years. However, the panel dataset is not balanced because several of the plans have data in the PENDAT dataset for fiscal year 1998,

which is used as the baseline year, not fiscal year 2000. The next fiscal year for those plans is 2001. There are only 2 other pension plans missing several years of data.

Figure 2 shows the average actuarial funding ratios for 1998 and 2000-2009. Funding ratios reached almost 100 percent in 2000 and 2001, with some pension system significantly overfunded. For the rest of the decade average funding ratios were on a downward path, reaching 79 percent in 2009. The summary statistics in Table 1 provide information across three levels – overall, between, and within. Overall takes into account all observations, while between and within provide the cross-section and time aspects of the variables' statistics. The average funding ratio over the entire period was 87 percent, with significant variation across plans and years. In 2000, 50 percent of the pension plans were well funded at 100 percent or higher, 38 percent were funded between 80 percent and 100 percent, and 12 percent of the pension plans were funded below 80 percent. In 2009, more than half of the plans (55 percent) were funded below 80 percent, and only 10 percent of the plans were fully funded or overfunded.

Figure 2: Average actuarial funding ratios, 1998-2009



Although there is significant change in the average funding levels during this period, an examination of worst and best performers reveals that the worst performers mostly came into the decade with already significantly underfunded pension plans, so their performance was a factor of accumulation of many years of underfunding and became worse as a result of market losses. Some of the worst performers in the PFS sample include: Indiana Teachers, Illinois SERS and Teachers, Oklahoma Teachers, New Hampshire Retirement System. For most of these systems the underfunded status was due to lower contributions than those required actuarially, as well as poor investment returns. The best funded pension systems were significantly overfunded at the beginning of the decade, but due to investment losses mostly, saw a reduction in their funding levels to 100% or lower. Some of the best performers include: New York State Teachers, New York State and Local, Florida, Georgia Teachers, and Washington Retirement Systems.

Average investment returns for the period were fairly low due to the stock market losses in 2008, as well as in 2000 and 2001. The average return of 3.4 percentage points varied from a low of 38 percent loss to a high of 33 percent gain, and varied significantly more across time than it did across the pension plans. This reflects the conversion to higher percent of equity investments for all pension plans and the volatility of the stock market returns over this period.

Contrary to investment returns, the assumed rate of return did not vary as much during that period, although it did vary more across plans than over time. The average assumed rate of return was 8 percent, and overall it varied from 4.5 percent to 9 percent. The assumed rate of return was not expected to vary as much over this period because it reflected the long-term expected return on investments, given the asset allocation of the pension plan. However, after the significant market losses in 2008, pension systems considered revising their long-term expectations downwards.

Table 1. Summary statistics for all dependent and independent variables

Variable		Mean	Std. Dev.	Min	Max	Observations
Funding Ratio	overall	87.33879	16.92329	19.1	151.12	N = 1179
	between		14.28848	30.174	121.113	n = 124
	within		9.070295	48.77379	139.2238	T-bar = 9.50806
Invest. Return	overall	3.385289	11.74288	-38.02	32.82	N = 1179
	between		2.217439	-7.3625	8.93	n = 124
	within		11.55777	-41.7936	29.59129	T-bar = 9.50806
Assumed Rate	overall	7.991993	.3967953	4.5	9	N = 1174
	between		.3532246	7.027778	8.8	n = 124
	within		.184523	5.191993	8.691993	T-bar = 9.46774
Elected Trustees	overall	31.128	30.08571	0	100	N = 1217
	between		30.15674	0	100	n = 124
	within		2.467431	5.673454	46.95217	T-bar = 9.81452
Appointed Trustees	overall	45.93042	31.74751	0	100	N = 1208
	between		31.61995	0	100	n = 124
	within		3.666443	25.93042	60.93043	T-bar = 9.74194
Exofficio Trustees	overall	18.72284	21.83872	0	100	N = 1217
	between		21.44329	0	100	n = 124
	within		3.124404	-.0683691	35.8657	TA-bar = 9.81452
Board Size	overall	9.969597	3.555929	1	20	N = 1217
	between		3.559163	1	18.77778	n = 124
	within		.4788133	8.069597	15.3696	T-bar = 9.81452
Board Expertise	overall	.398977	.4898969	0	1	N = 1173
	between		.4749346	0	1	n = 119
	within		.1343212	-.301023	1.298977	T-bar = 9.85714
Board Training	overall	.5842593	.4930776	0	1	N = 1080
	between		.47557	0	1	n = 110
	within		.1325079	-.0157407	1.484259	T-bar = 9.81818
Prudent Person	overall	.9545064	.2084735	0	1	N = 1165
	between		.2353241	0	1	n = 120
	within		.0278064	.0545064	1.054506	T-bar = 9.70833
Investment Council	overall	.318888	.4662362	0	1	N = 1223
	between		.4534954	0	1	n = 124
	within		.1098483	-.3174757	.918888	T-bar = 9.8629
Performance Evaluation	overall	.9784644	.1452293	0	1	N = 1068
	between		.2083436	0	1	n = 111
	within		0	.9784644	.9784644	T-bar = 9.62162
Annual Report	overall	.5475331	.4980352	0	1	N = 831
	between		.50014	0	1	n = 85
	within		0	.5475331	.5475331	T-bar = 9.77647
Statutory Contribution	overall	.2672727	.4427372	0	1	N = 1100
	between		.4659179	0	1	n = 118
	within		0	.2672727	.2672727	T-bar = 9.32203
Equities	overall	51.94502	17.70942	0	79.9	N = 1180
	between		11.27466	3.56	68.32	n = 124
	within		13.80305	-10.9772	98.77835	T-bar = 9.51613

Table 1 Continued

Real Estate	overall	4.592585	4.118566	0	19.8	N =	1180
	between		3.406244	0	11.37	n =	124
	within		2.289928	-6.777415	17.08147	T-bar =	9.51613
Alternatives	overall	5.134894	5.839561	0	30.6	N =	1179
	between		4.507405	0	17.48	n =	124
	within		3.688018	-8.315106	30.02489	T-bar =	9.50806
In-state Investments	overall	4.511321	10.93625	0	55	N =	424
	between		10.85886	0	55	n =	45
	within		0	4.511321	4.511321	T-bar =	9.42222
Investment Expense	overall	.2556702	.2269033	0	1.975196	N =	869
	between		.182065	.0098751	.9448701	n =	124
	within		.1311576	-.3780935	1.445917	T-bar =	7.00806
Plan Size	overall	16.08383	1.264676	7.381448	19.26772	N =	1151
	between		1.243988	12.63273	19.10086	n =	122
	within		.2355764	9.753953	17.04825	T-bar =	9.43443
SP500	overall	1.287903	20.12498	-37	28.69	N =	1197
	between		.4474994	-1.592222	2.685	n =	122
	within		20.12084	-38.3971	31.57013	T-bar =	9.81148
Benefit Increase	overall	.2254005	.418085	0	1	N =	874
	between		.2530531	0	1	n =	102
	within		.3456722	-.5745995	1.1254	T-bar =	8.56863
State Debt	overall	3194.634	1935.208	656.2349	11313	N =	1197
	between		1879.131	704.3088	9694.346	n =	122
	within		444.6339	1145.589	4813.285	T-bar =	9.81148
Year-end Balance	overall	10.43965	14.1884	-18.54	131.76	N =	1197
	between		12.22423	0	95.072	n =	122
	within		7.097672	-29.86235	47.12764	T-bar =	9.81148
Bond Rating	overall	6.132365	1.412546	1	8	N =	1171
	between		1.286465	3.3	8	n =	122
	within		.5641094	3.732365	8.832365	T-bar =	9.59836
Tax Revenue	overall	1.766926	6.279137	-32.98543	58.90427	N =	1075
	between		1.379613	-1.342359	8.215406	n =	122
	within		6.125787	-36.63723	55.25246	T-bar =	8.81148
Balanced Budget	overall	.6758563	.4682496	0	1	N =	1197
	between		.4682726	0	1	n =	122
	within		0	.6758563	.6758563	T-bar =	9.81148
Union	overall	40.21186	17.8674	10.4	74.8	N =	1197
	between		17.69197	12.86	72.09	n =	122
	within		2.703771	31.82186	51.23186	T-bar =	9.81148
Active Ratio	overall	2.177034	.7217548	.7183748	9.940708	N =	1097
	between		.5769598	1.033039	3.851009	n =	124
	within		.4293895	-.9556002	8.266733	T-bar =	8.84677
Amortization Period	overall	24.88805	8.071933	0	45	N =	611
	between		6.584689	1	37.33333	n =	118
	within		5.372533	-1.778614	45.22139	T-bar =	5.17797
Entry Age	overall	.7312287	.44351	0	1	N =	1172
	between		.4059287	0	1	n =	124
	within		.1748693	-.1576602	1.620118	T-bar =	9.45161

The governance variables can be separated in two groups based on how much they vary across time and pension plans. Board composition varies significantly across pension plans. On average, 30 percent of trustees are elected, 46 percent are appointed, and 19 percent are ex-officio. However, there are boards made up exclusively of each group. Board composition did change over time as well, although that was the case in about one-third of the pension systems. About 40 percent of the pension systems have board trustees with financial management and investment expertise, and about 60 percent require and provide periodic training to board trustees. About one-third of the systems have a separate investment council; this variable does not vary as much over time. Prudent person requirements, performance evaluations, annual reports, and statutory contribution do not vary over time, either. Both prudent person standards and performance evaluations are required in almost all pension systems, so there is not much variation in these variables.

On the other hand, the investment variables show significant variation both across plans and time. On average, more than 50 percent of assets are invested in equities, but that varies from 0 percent to 80 percent, and did vary over time significantly. Real estate and alternative investments each were on overage about 5 percent of assets, but again with significant variation. In-state investments do not vary over time because most systems either indicated they do not invest in-state, or if they did, they provided the target number, not the actual investments. Also, systems that have in-state investments that are not targeted do not keep record of the percent of assets invested in-state and responded that the amount was zero.

From the political variables, benefit increases varied somewhat between plans and across time, although most of these occurred in the early 2000s. State fiscal variables vary significantly, as it might be expected, except balanced budget requirements, which are based on

2008 data. Union membership also varies significantly, mostly across states, but somewhat over time as well.

Pooled OLS

Pooled OLS ignores the time dimension of the panel dataset and treats each observation as a cross-sectional observation. Pooling panel data assumes that there are no significant group or time effects. Further, pooled OLS requires exogeneity of all regressors, no serial correlation, and homoskedasticity of the error terms for consistent estimation of the coefficients (Wooldridge, 2002). Issues of serial correlation and heteroskedasticity can be addressed with robust standard errors because the regular standard errors are biased downward. However, if there are system-specific fixed effects, the lagged dependent variable $y_{i,t-1}$ will be correlated with the fixed effect μ_i , and the coefficient estimates will be inconsistent. Therefore, pooled OLS to estimate the funding ratio cannot be justified with the presence of the lagged funding ratio in the equation, if there are fixed effects. However, earlier studies of pension system performance conducted with longitudinal data used pooled OLS for the estimation of the equations and the estimation here is used to provide a level of comparison with the results from these studies (Yang and Mitchell, 2005). Due to the relatively large number of observations and short time period, the OLS regressions include time dummy variables to allow for aggregate time effects on the dependent variables.

The results from the pooled OLS regressions for the funding ratio, investment return, and assumed rate of return are shown in Tables 2, 3, and 4, respectively. Each table has six regressions per dependent variable. The first regression includes only the governance variables, as well as endogenous variables and lags of the funding ratio. The second regression includes the variables from the complete model.

Table 2. Pooled OLS, Funding Ratio, with serial correlation and heteroskedasticity robust standard errors

	(1)	(2)	(3)	(4)	(5)	(6)
Lag fund ratio	0.902***	0.869***	0.895***	0.863***	0.894***	0.859***
	(0.0211)	(0.0318)	(0.0221)	(0.0314)	(0.0208)	(0.0324)
Investment return	0.0504	0.0419	0.0509	0.0439	0.0423	0.0389
	(0.0510)	(0.0555)	(0.0510)	(0.0559)	(0.0506)	(0.0544)
Elected	-0.0406*	-0.0230	-0.0251	-0.00459		
	(0.0218)	(0.0228)	(0.0261)	(0.0272)		
Appointed	-0.0274	-0.0128	-0.0246	-0.00703	0.00991	0.0101
	(0.0220)	(0.0225)	(0.0259)	(0.0278)	(0.00780)	(0.00826)
Exofficio	-0.0156	-0.00202	-0.0114	0.00324	0.0309**	0.0291**
	(0.0278)	(0.0276)	(0.0276)	(0.0251)	(0.0133)	(0.0144)
Board size	0.114	0.136	0.147*	0.184	0.0667	0.157
	(0.0852)	(0.129)	(0.0875)	(0.135)	(0.0874)	(0.130)
Expertise	-0.111	-0.181	0.551	0.823	-0.125	-0.254
	(0.501)	(0.513)	(1.867)	(1.805)	(0.533)	(0.546)
Training	1.023*	0.505	1.517**	1.002*	0.925*	0.534
	(0.610)	(0.535)	(0.626)	(0.559)	(0.508)	(0.465)
Prudent person	0.365	-0.163	0.852*	0.346	0.496	-0.242
	(0.465)	(0.643)	(0.485)	(0.877)	(0.507)	(0.531)
Annual report	0.515	-0.616	0.442	-0.757	0.331	-0.598
	(0.543)	(0.547)	(0.553)	(0.496)	(0.497)	(0.546)
Performance eval	-0.932	0.305	-0.549	0.723	-0.352	1.413*
	(1.801)	(1.378)	(1.856)	(1.510)	(1.200)	(0.726)
Statutory contr.	-0.273	-0.390	-0.242	-0.352	-0.443	-0.539
	(0.487)	(0.471)	(0.479)	(0.460)	(0.453)	(0.495)
Lag benefit increase		1.088*		0.968*		1.515**
		(0.581)		(0.570)		(0.570)
Change revenues		-0.00363		-0.00581		-0.0302
		(0.0401)		(0.0436)		(0.0427)
Debt		3.60e-05		8.58e-06		0.000130
		(0.000288)		(0.000296)		(0.000246)
Balance unreserved		-0.0119		-0.0132		0.00323
		(0.0194)		(0.0199)		(0.0181)
Bond rating		0.449***		0.420**		0.573***
		(0.165)		(0.168)		(0.169)
BBR		-0.173		0.256		-0.150
		(0.645)		(0.629)		(0.651)
Union		0.0244		0.0243		0.0298*
		(0.0150)		(0.0153)		(0.0154)
Elected*expertise			-0.0372	-0.0425*		
			(0.0247)	(0.0239)		
Appointed*expertise			0.00730	0.00291		
			(0.0233)	(0.0263)		
Active					0.00324	0.00951
					(0.00998)	(0.0123)
Retired					-0.0642***	-0.0608***
					(0.0153)	(0.0145)
Constant	4.903	2.735	3.367	0.660	2.507	-1.187
	(3.646)	(5.078)	(3.671)	(5.529)	(2.809)	(4.324)
Observations	543	422	543	422	538	422
R-squared	0.891	0.874	0.893	0.875	0.894	0.877

*** p<0.01, ** p<0.05, * p<0.1

The other two equations include interaction terms between expertise requirements and board composition. The last two regressions replace the variable for elected trustees with variables indicating the percent of active and retired plan members serving on the board. All regressions were estimated with robust standard errors for serial correlation and heteroskedasticity.

There are not that many statistically significant coefficients in the regressions for the funding ratio, with the notable exception of the last regression. When only governance factors are included in the equation, it appears that having more elected trustees on the board is associated with lower funding ratios, although the coefficient is only significant at the 10 percent level. The coefficient for training is also significant and positive in the first regression. However, when the other variables are included in the regression, none of the governance variables are significant. The only fiscal stress variable that is significant in the second regression is bond rating, which has the expected positive sign.

After adding interaction terms between expertise and board composition to the governance variables, none of these variables are significant. Training, however, remains positive and significant in both regressions. The full regression with all variables and interaction terms indicates that having expertise requirements for serving on the board and more elected trustees together are associated with lower funding ratios.

One of the empirical disagreements in the existing literature regards the proper measure of board composition for plan members. Most of the studies include the percent of trustees who are plan members (or active and retired plan members) as the variables of interest. However, Romano (1993) argues that only elected trustees are really accountable to plan members through the election process. Instead of measuring the percent of active and retired members, the focus should be on elected members because only they are held accountable for their decisions by

other pension plan members. However, whether they are elected or not, pension plan members' interests are aligned with those of all members due to their personal stake. Additionally, there is the concern that active and retired members have different incentives regarding the funding status of the pension plans. Therefore, the last two regressions replace the elected trustees with the percent active and retired plan members serving on the board.

The results in the last column of Table 2 are probably the most interesting in relation to the hypotheses in this study. The results indicate that a higher number of retired plan members on the pension board are associated with lower funding ratios. Also, ex-officio trustees are associated with higher funding ratios. Other coefficients, although only marginally significant, include independent performance evaluations and the level of state employee unionization as positive predictors of funding levels.

The investment regressions shown in Table 3 similarly do not have many significant variables of interest. In terms of governance variables, ex-officio trustees are associated with lower investment returns in both the governance only regression and the full regressions. This result reaches greater statistical significance after elected trustees are replaced with active and retired trustees as the board composition variables. The prudent person requirement is positive and significant in the governance-only regression, but loses signficance in the full regression. The other significant coefficients are associated with the investments in equities and alternatives, both positively related to investment return. Investment expense is negatively related to investment return, as expected. The interaction between expertise and board composition is significant only in the governance only regression, but not in the full model.

Table 3. Pooled OLS, Investment Return, with serial correlation and heteroskedasticity robust standard errors

	(1)	(2)	(3)	(4)	(5)	(6)
Fund ratio	0.114	0.156	0.117	0.163	0.110	0.156
	(0.0981)	(0.124)	(0.0994)	(0.124)	(0.0996)	(0.128)
Lag fundratio	-0.139	-0.172	-0.138	-0.170	-0.137	-0.172
	(0.0969)	(0.122)	(0.0985)	(0.123)	(0.0976)	(0.125)
Elected	0.00347	-0.00934	-0.00928	-0.0293		
	(0.0171)	(0.0329)	(0.0192)	(0.0436)		
Appointed	-0.00128	-0.00308	-0.0115	-0.0191	-0.00508	0.00534
	(0.0197)	(0.0331)	(0.0215)	(0.0415)	(0.00665)	(0.0107)
Exofficio	-0.0451*	-0.0785*	-0.0347	-0.0678	-0.0489***	-0.0674***
	(0.0235)	(0.0418)	(0.0219)	(0.0423)	(0.0163)	(0.0207)
Board size	0.0753	0.176*	0.0314	0.137	0.0690	0.164*
	(0.0657)	(0.0902)	(0.0672)	(0.0909)	(0.0629)	(0.0844)
Expertise	0.341	0.690	-2.405	-3.058	0.411	0.684
	(0.420)	(0.652)	(1.705)	(3.464)	(0.385)	(0.648)
Training	0.236	-0.00845	0.0545	-0.351	0.187	0.0994
	(0.355)	(0.479)	(0.374)	(0.568)	(0.392)	(0.515)
Prudent person	1.174*	0.668	1.045*	0.491	1.155*	0.735
	(0.633)	(1.160)	(0.593)	(1.181)	(0.669)	(1.202)
Annual report	0.170	0.353	0.388	0.642	0.133	0.209
	(0.352)	(0.415)	(0.349)	(0.451)	(0.370)	(0.418)
Performance eval	-0.295	2.093*	-0.409	1.885	-0.192	2.268*
	(0.821)	(1.227)	(0.742)	(1.153)	(0.727)	(1.213)
Equities		0.109***		0.102***		0.111***
		(0.0319)		(0.0311)		(0.0325)
Real estate		-0.138		-0.158		-0.118
		(0.0971)		(0.106)		(0.0907)
Alternatives		0.134**		0.114		0.144*
		(0.0661)		(0.0843)		(0.0723)
Plan size		-0.224		-0.204		-0.244
		(0.225)		(0.243)		(0.210)
sp500		-0.0773*		-0.0770*		-0.0772*
		(0.0436)		(0.0437)		(0.0438)
Investment expense		-2.951*		-3.061*		-3.093*
		(1.696)		(1.665)		(1.610)
Elected*expertise			0.0440*	0.0585		
			(0.0235)	(0.0439)		
Appointed*expertise			0.0312	0.0426		
			(0.0234)	(0.0441)		
Active					0.00335	0.00887
					(0.00954)	(0.0145)
Retired					-0.0100	-0.00203
					(0.0108)	(0.0180)
Constant	-11.64***	-13.13***	-10.59***	-11.33**	-11.13***	-14.46***
	(3.143)	(4.251)	(3.346)	(5.165)	(2.682)	(4.549)
Observations	598	489	598	489	593	487
R-squared	0.686	0.673	0.687	0.674	0.686	0.673

*** p<0.01, ** p<0.05, * p<0.1

The regressions for the assumed rate of return in Table 4 also indicate a few significant results. Among them, it is important to note that the assumed rate of return does not appear to be related to the asset allocation of the pension system, except for alternative investments. Although the assumed rate of return measures expected long-term return, the asset allocation of pension plans on average had not experienced large changes since the 1990s. Therefore, the assumed rate of return was expected to be related to the current asset allocation as an indicator that it is determined on the basis of the expected return of the asset mix rather than other factors.

Elected trustees are associated with higher assumed rates of return, which is contrary to the expectations based on agency theory. If elected trustees are aware of the importance of the assumed rate of return, they should aim for a relatively lower rate, after controlling for asset allocation. After the interaction terms are added to the regressions, the results indicate that expertise and training requirements are associated with lower assumed rates of return, while having both the requirements and elected trustees are associated with higher assumed rates of return. Changing from elected trustees to active and retired plan members does not generate any significant results for the new measures, while ex-officio trustees appear to be associated with lower assumed rates.

Table 4. Pooled OLS, Assumed Rate of Return, with serial correlation and heteroskedasticity robust standard errors

	(1)	(2)	(3)	(4)	(5)	(6)
Fund ratio	-0.00928***	-0.00870***	-0.00911***	-0.00845***	-0.00971***	-0.00969***
	(0.00236)	(0.00223)	(0.00233)	(0.00216)	(0.00250)	(0.00223)
Lag fund ratio	0.00481**	0.00457**	0.00510**	0.00490**	0.00501**	0.00518**
	(0.00234)	(0.00224)	(0.00237)	(0.00228)	(0.00237)	(0.00225)
Equities	-0.000163	0.000903	-0.000245	0.000914	0.00128	0.00228
	(0.00177)	(0.00153)	(0.00178)	(0.00157)	(0.00178)	(0.00160)
Real estate	0.00875	0.00360	0.00530	-0.000969	0.00832	0.00362
	(0.00553)	(0.00545)	(0.00588)	(0.00572)	(0.00597)	(0.00614)
Alternatives	0.0207***	0.0169***	0.0197***	0.0163***	0.0198***	0.0163***
	(0.00400)	(0.00399)	(0.00408)	(0.00408)	(0.00410)	(0.00420)
Elected	0.00392**	0.00492***	0.00167	0.00242		
	(0.00183)	(0.00150)	(0.00206)	(0.00193)		
Appointed	0.00109	0.00259	-0.000848	0.000805	-0.00216*	-0.00179
	(0.00204)	(0.00171)	(0.00236)	(0.00223)	(0.00123)	(0.00126)
Exofficio	-0.000708	0.000933	-0.000293	0.00129	-0.00378**	-0.00361**
	(0.00241)	(0.00209)	(0.00275)	(0.00213)	(0.00172)	(0.00180)
Board size	-0.00961	-0.00549	-0.0128	-0.00922	-0.00963	-0.00662
	(0.00915)	(0.00803)	(0.00911)	(0.00827)	(0.00932)	(0.00847)
Expertise	0.0173	-0.0200	-0.298	-0.334**	0.0287	-0.00394
	(0.0478)	(0.0496)	(0.181)	(0.154)	(0.0461)	(0.0513)
Training	-0.100*	-0.0775	-0.119*	-0.0994*	-0.0855	-0.0763
	(0.0599)	(0.0598)	(0.0622)	(0.0596)	(0.0616)	(0.0614)
Change revenues		0.00141		0.00139		0.000764
		(0.00124)		(0.00117)		(0.00121)
Debt		8.85e-07		5.11e-07		7.25e-07
		(1.81e-05)		(1.85e-05)		(2.35e-05)
Balance unreserved		0.00149		0.00211		0.00148
		(0.00147)		(0.00158)		(0.00163)
Bond rating		0.00924		0.00678		-0.00170
		(0.0162)		(0.0161)		(0.0164)
BBR		-0.0311		-0.0409		-0.0212
		(0.0644)		(0.0638)		(0.0680)
Union		0.00669***		0.00685***		0.00545**
		(0.00178)		(0.00177)		(0.00211)
Elected*expertise			0.00509**	0.00591**		
			(0.00256)	(0.00252)		
Appointed*expertise			0.00342	0.00287		
			(0.00236)	(0.00211)		
Active					0.000396	0.00105
					(0.00143)	(0.00164)
Retired					0.000938	0.000923
					(0.00209)	(0.00216)
Constant	8.038***	7.551***	8.239***	7.762***	8.266***	7.988***
	(0.304)	(0.326)	(0.311)	(0.364)	(0.252)	(0.308)
Observations	909	900	909	900	861	852
R-squared	0.249	0.352	0.265	0.374	0.225	0.297

*** p<0.01, ** p<0.05, * p<0.1

Another issue that needs to be considered in the analysis of pension fund performance is the nature of the sample of public pension plans. Some studies focus on state pension plans only (Chaney et al., 2002; Romano, 1993; Murphy and Van Nuys, 1994), while most of the other studies use a combination of state and local pension plans that participated in the PENDAT survey. However, due to the focus on political interference and its impact on pension funds, state and local pension plans may be under different levels of political pressure. To see if there are any different effects of the governance and political variables, separate regressions were run for the 104 state plans, excluding the 20 local plans. However, an examination of the regression results for state pension plans only does not reveal any qualitatively or quantitatively different results than those obtained for all pension plans. On the other hand, the Public Fund Survey follows the largest local pension plans, which may be subject to as much political pressure as state local plans. Romano (1993) argues that the extent of political pressure is proportionate to the size of the pension plan.

Another alternative specification of the models involves the interaction of fiscal stress with board composition in the funding ratio and the assumed rate equations. The only significant coefficient from the interactions in the funding ratio regression is the interaction between active member trustees and BBRs, which is negative but very small in magnitude. The results for the assumed rate of return indicate that having more active member trustees on the board is associated with lower assumed rates, consistent with agency theory. On the other hand, the interaction between active member trustees and BBRs is positive, contrary to agency-based hypotheses. In this regression, pension plans in states with BBRs have lower assumed rates, which is contrary to the expectations that BBRs force states to close budget gaps with other funds.

A final alternative specification included interactions between fiscal stress and BBRs to determine if there are any different impacts of fiscal stress for states with BBRs. However, none of the interaction coefficients are significant in these specifications and there is not significant change in the other coefficients.

In summary, there is very limited support for the agency theory hypotheses from the pooled OLS regressions. Ex-officio trustees appear to have a positive impact on funding levels, but negative impact on investment returns. Retired member trustees are associated with lower funding levels, supporting the idea that they are more concerned with enhancing their benefits than the long-term sustainability of the pension funds. Performance evaluations have a positive impact on both funding and investment return but are only marginally significant. Finally, fiscal stress does not appear to have any effect on funding levels and assumed rates of return, contrary to earlier studies finding such an effect (Chaney et al., 2002; Eaton and Nofsinger, 2004).

Arellano-Bond Estimation

The results from the Arellano-Bond regressions for the funding ratio are shown in Table 5. These regressions were estimated with the one-step Difference GMM estimator, which differences out the time invariant variables from the model. The coefficients for the exogenous variables show the impact of changes in these variables on changes in the dependent variable. The coefficients for the endogenous variables show the impact of lagged levels of the endogenous variables on changes in the dependent variable.

Table 5. Arellano-Bond Regressions, Difference GMM, Funding Ratio

	(1)	(2)	(3)
Lag fund ratio	0.652***	0.680***	0.687***
	(0.123)	(0.153)	(0.135)
Investment return	0.0905	0.149**	0.142*
	(0.0594)	(0.0734)	(0.0730)
Lag benefit increase	3.576*	4.601**	4.683**
	(1.893)	(2.122)	(1.927)
Elected	-0.328**	-0.377**	-0.375**
	(0.167)	(0.164)	(0.161)
Appointed	-0.448***	-0.454***	-0.462***
	(0.129)	(0.121)	(0.121)
Exofficio	-0.469***	-0.482***	-0.485***
	(0.156)	(0.150)	(0.142)
Board size	-0.608	-0.787	-0.828
	(0.604)	(0.609)	(0.590)
Expertise	5.263*	4.698	4.529
	(2.912)	(3.109)	(3.174)
Training	2.324	2.676	2.958
	(2.310)	(2.818)	(2.765)
Change revenues	-0.0401	-0.0381	-0.0394
	(0.0490)	(0.0501)	(0.0487)
Debt	-0.00192	-0.00207	-0.00197
	(0.00200)	(0.00218)	(0.00222)
Balance	0.0238	0.0242	0.0189
	(0.0344)	(0.0381)	(0.0374)
Bond rating	0.540	0.546	0.567
	(0.527)	(0.585)	(0.579)
Union	-0.0220	-0.0183	-0.0215
	(0.0990)	(0.118)	(0.114)
Constant	68.74***	70.85***	70.55***
	(22.38)	(21.53)	(21.49)
Observations	363	363	363
Number of plans	51	51	51

*** p<0.01, ** p<0.05, * p<0.1

The three regressions in Table 5 test different lag structures for the endogenous variables: funding ratio, investment return and benefit increases. The first equation has two lags for each endogenous variable, the second only one lag for each variable, and the third a combination of different lags. Specifically, two lags, at time periods *t-2* and *t-3* are used for the funding ratio, one lag, at *t-2* for the investment return and one lag at *t-3* for benefit increases. The Arelleno-

Bond post-estimation tests for serial correlation found no evidence of serial correlation in the three regressions. The coefficients are consistent and the Arellano-Bond estimator can be used. The last regression had the highest p-value for the Sargan test (p= 0.0984), which confirms that the number of instruments were appropriate as selected in this equation. The Sargan tests from the other two regressions rejected the null hypotheses that the overidentifying restrictions (the number of lagged instruments) were valid as specified.

The most important results from Table 5 are the coefficients on the lagged funding ratio and investment return now estimated with the instrumental variables generated from their lagged levels in the previous periods. In the Arellano-Bond estimation, this means that lagged levels of funding and investment return are associated with positive changes in funding ratios. If we compare the coefficients from the pooled OLS regression, we can see that the coefficient for the lagged funding ratio was substantially higher than the one from the Arellano-Bond estimation. The corresponding equation in Table 2 is equation (4), where the coefficient for the lagged funding ratio is 0.863, while the funding ratio coefficient from the third regression in Table 5 is 0.687. This result lends support to the idea that there are fixed effects in the error term of the pooled OLS regression that are correlated with the lagged funding ratio and therefore inflate its coefficient. Furthermore, investment return is now a significant and positive predictor of changes in the funding ratio.

Unfortunately, the board composition results from Table 5 are difficult to interpret in terms of the hypotheses laid out in this study because they show the effect of changes in board composition on changes in the funding ratio. The coefficients on the board composition variables are all negative and significant. This implies that changes in the three types of board composition are associated with negative changes in funding levels. One way to interpret this

result is that changes in board composition may have disrupted the operations of the board until new people become oriented to their positions, therefore impairing pension performance. Another possible interpretation is that these changes are part of larger reforms to the pension plans that are not controlled for in the equations and that may have resulted in lower funding ratios. When elected trustees are replaced with active and retired member trustees, none of the board composition variables are significant (Table 6).

The regressions for investment return and the assumed rate of return in Table 6 do not have any significant results with regard to the governance variables. The asset allocation variables for investment return are significant. Changes in equities are associated with positive changes in investment return, while changes in real estate and alternative investments are associated with negative changes in investment return. There is one significant governance variable after elected trustees are replaced with active and retired member trustees. The coefficient for active trustees is positive and strongly significant, indicating that changes in the proportion of active trustees are associated with increases in investment return.

The last two columns in Table 6 test the interaction effects between fiscal stress, BBRs, and board composition on pension funding and assumed rates of return. Changes in the number of appointed trustees for pension plans in states without balanced budget requirements is associated with positive changes in funding ratios. On the other hand, changes in the number of appointed trustees in states with BBRs is associated with negative changes in pension funding levels. The latter result is the only direct support so far for the potential agency issues and their interplay with state fiscal constraints. The two other significant coefficients are associated with fiscal stress and retired member trustees. Changes in retired trustees and debt per capita are

associated with negative changes in funding ratios, while changes in bond ratings and retired trustees are associated with positive funding ratios.

In the equation for the assumed rate of return, changes in the proportion of active trustees without the presence of fiscal stress are associated with higher discount rates. This result does not have a very intuitive explanation, because we expected that member trustees will be associated with lower discount rates, which result in more prefunding of the pension plan. On the other hand, the interaction between active and retired trustees and debt per capita has the expected negative sign.

Table 6. Arellano-Bond Regressions, Difference GMM, Alternative Specifications

	(1) Fund ratio	(2) Invest return	(3) Assumed rate	(4) Fund ratio	(5) Assumed rate
Lag fund ratio	0.693***	-0.0746	0.00574	0.765***	0.00647
	(0.137)	(0.334)	(0.00393)	(0.149)	(0.00403)
Investment return	0.118			0.140*	
	(0.0725)			(0.0756)	
Appointed	-0.132	-0.112	-0.00142	1.783***	0.0198
	(0.101)	(0.137)	(0.00233)	(0.498)	(0.0139)
Exofficio	0.146	-0.753	-0.00435	-0.0774	-0.00269
	(0.539)	(0.670)	(0.00409)	(0.605)	(0.00460)
Board size	-0.231	-2.263	-0.0152	-3.012***	-0.0162
	(1.120)	(2.672)	(0.0140)	(0.960)	(0.0199)
Expertise	9.513	11.77	0.00142	2.287	0.00276
	(6.814)	(8.245)	(0.0611)	(6.447)	(0.0626)
Training	2.624	-21.49***	0.0373	3.856	0.0504
	(2.684)	(6.608)	(0.0599)	(2.741)	(0.0614)
Active*Debt				4.85e-06	-1.76e-06**
				(6.41e-05)	(8.41e-07)
Active*Balance				0.000561	-4.36e-05
				(0.00242)	(3.91e-05)
Active*Rating				-0.0236	-0.000925**
				(0.0351)	(0.000448)
Active*BBR				-0.0497	-0.0102
				(0.375)	(0.00760)
Retire*Debt				-0.000263***	-2.06e-06*
				(6.09e-05)	(1.17e-06)
Retired*Balance				0.00155	4.41e-05
				(0.00189)	(4.19e-05)
Retired*Rating				0.232*	0.00203**
				(0.119)	(0.000983)

Table 6 Continued

Retired*BBR				0.877	-0.00533
				(0.805)	(0.0106)
Apointed*Debt				3.03e-05	-5.64e-08
				(2.94e-05)	(4.40e-07)
Appointed*Balance				0.000555	9.62e-06
				(0.00140)	(2.07e-05)
Appointed*Rating				0.00412	-0.000206
				(0.0223)	(0.000295)
Appointed*BBR				-2.284***	-0.0206
				(0.545)	(0.0148)
Lag benefit increase	4.110**			5.053**	
	(2.067)			(2.313)	
Change revenues	-0.0396		0.000350	0.0235	0.000912
	(0.0470)		(0.000672)	(0.0440)	(0.000691)
Debt	-0.00190		-2.73e-05	0.00191	9.80e-05
	(0.00221)		(1.84e-05)	(0.00538)	(6.32e-05)
Balance	0.0220		-0.000799	-0.0627	-1.18e-05
	(0.0371)		(0.000619)	(0.191)	(0.00280)
Bond rating	0.687		-0.0102	-0.779	0.0150
	(0.568)		(0.00773)	(2.580)	(0.0301)
Union	-0.00578		0.000352	-0.0498	0.000211
	(0.111)		(0.00136)	(0.100)	(0.00138)
Fiscal year	-0.929*	5.284	-0.0164***	-0.916*	-0.0175***
	(0.501)	(5.270)	(0.00479)	(0.488)	(0.00485)
Active	-0.142	0.980***	0.00120		0.0204**
	(0.189)	(0.363)	(0.00318)		(0.00805)
Retired	0.0495	0.157	-0.000766		
	(0.168)	(0.177)	(0.00210)		
Fund ratio		1.403	-0.00673		-0.00727*
		(1.506)	(0.00434)		(0.00421)
Equities		0.230**	-0.000197		-9.21e-05
		(0.110)	(0.000335)		(0.000343)
Real estate		-1.668***	0.00285		0.00326
		(0.544)	(0.00196)		(0.00199)
Alternatives		-0.698**	-2.19e-05		-0.000345
		(0.296)	(0.00140)		(0.00143)
Plan size		-79.44			
		(81.68)			
SP500		-0.0654			
		(0.0453)			
Investment expense		-10.17			
		(6.420)			
Observations	370	415	747	370	747
Number of planid	58	71	104	58	104

*** p<0.01, ** p<0.05, * p<0.1

Three-Stage Least Squares

The 3SLS regression results are presented in Table 7. All variables are first-differenced to eliminate the plan-specific fixed effects, and the coefficients show the change in the dependent variable in response to a change in the independent variable. Table 7 shows the results from the 3SLS simultaneous equations as well as 2SLS equation by equation regressions. In the 3SLS estimation, the endogenous variables are the three dependent variables – the funding ratio, investment return, and the assumed rate of return. The excluded instruments for the funding ratio include the statutory required contribution, which does not appear in the other two equations, as well as the added instrumental variables active ratio, amortization period, and entry age actuarial method. The instruments for the investment return include S&P500, plan size, investment expense, and the added instrumental variable investment council.

The F-statistic from the first-stage regression is high only for the funding ratio equation, where it is equal to 33.79. The rule of thumb for the F-statistic with one endogenous variable is that it should be more than 10. This is not the case for the other two endogenous variables. We also performed separate Sargan tests for the overidentifying restrictions in each equation. The null hypothesis that the overidentifying restrictions for the endogenous investment return are valid was rejected. The Sargan test did not reject the validity of the instruments for the funding ratio and lagged funding ratio.

Table 7. 3SLS and 2SLS, Funding Ratio, Investment Return, and Assumed Rate of Return

	(1) 3SLS Fund ratio	(2) 3SLS Invest return	(3) 3SLS Assumed rate	(4) 2SLS Fund ratio	(5) 2SLS Invest return	(6) 2SLS Assumed rate
Fund ratio	0.186***	-0.822***	0.00120	0.179**	-0.727***	0.000965
	(0.0672)	(0.169)	(0.00106)	(0.0697)	(0.175)	(0.00109)
Investment return	0.0814**			0.0784**		
	(0.0364)			(0.0378)		
Appointed	-0.0231	-0.133	-0.000477	-0.0225	-0.157	-0.000408
	(0.110)	(0.302)	(0.00203)	(0.114)	(0.312)	(0.00210)
Exofficio	-0.175	0.588	-0.000286	-0.173	0.543	-0.000106
	(0.162)	(0.437)	(0.00297)	(0.168)	(0.451)	(0.00307)
Board size	1.241	-8.538	-0.00673	1.278	-9.323	-0.00641
	(2.211)	(5.856)	(0.0405)	(2.294)	(6.050)	(0.0418)
Expertise	-6.250	52.74**	0.0335	-6.267	55.18**	0.0328
	(8.045)	(21.08)	(0.145)	(8.343)	(21.78)	(0.150)
Training	3.360	-22.53**	0.0172	3.260	-22.29**	0.0149
	(3.384)	(9.153)	(0.0603)	(3.506)	(9.458)	(0.0622)
Lag benefit incr.	0.734			0.854		
	(0.747)			(0.791)		
Change revenue	-0.0238		0.00105**	-0.0375		0.000888
	(0.0289)		(0.000532)	(0.0305)		(0.000556)
Debt	0.000455		-9.38e-07	0.000288		-4.17e-06
	(0.00128)		(2.36e-05)	(0.00135)		(2.47e-05)
Balance	0.0801**		-0.000144	0.0813**		-0.000247
	(0.0345)		(0.000649)	(0.0364)		(0.000679)
Bond rating	1.602***		-0.0133	1.708***		-0.0142
	(0.578)		(0.0109)	(0.608)		(0.0114)
Union	-0.0117		0.00134	-0.0329		0.00105
	(0.0844)		(0.00157)	(0.0893)		(0.00164)
Fund ratio		0.909	1.60e-06		0.782	0.00148
		(0.939)	(0.00128)		(0.991)	(0.00132)
Equities		0.536***	-0.000506		0.572***	-0.000579
		(0.0979)	(0.000673)		(0.102)	(0.000696)
Real estate		-1.076***	0.00256		-1.158***	0.00279
		(0.360)	(0.00240)		(0.379)	(0.00249)
Alternatives		-0.457*	-0.00106		-0.490*	-0.000948
		(0.256)	(0.00167)		(0.269)	(0.00173)
Plan size		12.73			-11.57	
		(61.31)			(64.78)	
SP500		0.0698**			0.0801**	
		(0.0311)			(0.0330)	
Invest expense		-18.94***			-17.32***	
		(6.216)			(6.613)	
Constant	-1.284***	-1.510	-0.0126*	-1.304***	-1.211	-0.0105
	(0.363)	(2.772)	(0.00655)	(0.378)	(2.921)	(0.00678)
Observations	294	294	294	294	294	294
R-squared	0.067	0.354	0.027	0.070	0.372	0.043

*** p<0.01, ** p<0.05, * p<0.1

None of the governance variables are significant for all three equations. Changes in the fiscal variables year-end balance and bond rating are associated with positive changes in funding ratios. Asset allocation results are similar to those in the Arellano-Bond estimation. Changes in expertise requirements have a significant and large effect on changes in investment return, while changes in training requirements have a large negative effect on investment return. The large coefficients can be explained by the fact that expertise and training are dummy variables and do not change much, so when they change they have a disproportionately large impact. Expertise has the expected positive sign, but the negative sign for training is difficult to explain. One possible explanation may be that some of the training is conducted by investment managers and they may influence board decisions in a negative way. There does not appear to be to significant difference between the 3SLS and 2SLS coefficients, although the standard errors are slightly lower on average in the 3SLS regressions.

An alternative specification with active and retired member trustees did not generate significantly different results with the exception of the variable for ex-officio trustees. Specifically, changes in the proportion of ex-officio trustees are associated with negative changes in investment return, which is similar to the result from the pooled OLS.

Lagged levels of the funding ratio (t-2 and t-3) and for investment return (t-2) were also added as instruments, but did not generate any significantly different results in the estimation. The investment return lag did not change the Sargan test result for investment return, which still rejects the null that the overidentifying restrictions are valid.

Sensitivity Analysis

The regression results presented above used a relatively small part of the data due to many missing values for several variables, including the pension fund investment expense, annual reports and benefit increases. This section discusses the regression results after imputing data for these three variables. The pension investment expense is a continuous variable which measures the investment expense as a percent of total pension assets. For most pension systems, the missing values were from some years, and there was data available for other years. So, the imputed values for the pension investment expense variable are based on the unconditional mean for each pension fund.

On the other hand, the variables for annual reports and benefit increases are binary indictors, and the missing values are observed for all years for certain pension plans. The missing values for these variables were imputed based on their conditional mean, after regressing each variable on a set of independent variables and getting the predicted values. As a result of the imputed data, the observations for the equations with the funding ratio and investment return almost doubled.

The analysis with the imputed data is presented in Tables 8 through 10. Table 8 presents the Pooled OLS results for the three equations, with alternative specifications for board composition. There are two notable differences in the results for the funding ratio. In addition to the significant negative effect of retired trustees, now the effect of active trustees is positive and significant, providing some support for agency theory. Furthermore, now three of the four fiscal stress variables are significant and with the expected signs. Specifically, higher bond ratings and higher year-end balances are associated with better funding ratios, while higher debt per capita is associated with lower funding ratios. These results are in line with earlier cross-section studies

that fiscal stress at the state level impacts negatively pension funding levels. In the investment equations, board expertise and prudent person rule are now positive and significant predictors of investment return.

Table 8. Pooled OLS, with serial correlation and heteroskedasticity robust standard errors, Imputed Data

	(1) Fund ratio	(2) Fund ratio	(3) Invest return	(4) Invest return	(5) Assumed rate	(6) Assumed rate
Lag fund ratio	0.897***	0.891***	-0.182*	-0.184*	0.00459**	0.00522**
	(0.0158)	(0.0173)	(0.0979)	(0.0996)	(0.00224)	(0.00225)
Investment return	0.0737	0.0704				
	(0.0450)	(0.0442)				
Active		0.0190**		0.0118		0.00109
		(0.00930)		(0.0108)		(0.00162)
Retired		-0.0561***		0.00390		0.000920
		(0.0173)		(0.0126)		(0.00216)
Elected	-0.0316		0.0104		0.00494***	
	(0.0193)		(0.0300)		(0.00150)	
Appointed	-0.0216	0.00493	-0.00414	-0.0109	0.00259	-0.00182
	(0.0190)	(0.00701)	(0.0320)	(0.00687)	(0.00171)	(0.00125)
Exofficio	-0.0109	0.0125	-0.0333	-0.0427***	0.000978	-0.00360**
	(0.0217)	(0.00916)	(0.0340)	(0.0115)	(0.00209)	(0.00180)
Board size	0.139*	0.105	-0.00401	0.0236	-0.00523	-0.00635
	(0.0709)	(0.0682)	(0.0631)	(0.0681)	(0.00801)	(0.00847)
Expertise	0.00935	0.0793	0.944**	1.089**	-0.0217	-0.00568
	(0.441)	(0.428)	(0.442)	(0.428)	(0.0492)	(0.0510)
Training	0.390	0.372	0.0745	0.135	-0.0765	-0.0752
	(0.479)	(0.472)	(0.387)	(0.405)	(0.0595)	(0.0610)
Prudent person	0.528	0.393	1.751**	1.874**		
	(0.607)	(0.573)	(0.718)	(0.754)		
Annual report	0.720	0.424	0.0705	0.0884		
	(0.511)	(0.507)	(0.413)	(0.415)		
Performance eval	-0.211	0.814	0.710	0.777		
	(2.029)	(1.305)	(0.645)	(0.603)		
Statutory contr.	-0.259	-0.377				
	(0.374)	(0.358)				
Lag benefit increase	1.048*	1.352**				
	(0.529)	(0.596)				
Change revenues	-0.000725	-0.0342			0.00141	0.000755

Table 8 Continued

	(0.0305)	(0.0308)			(0.00123)	(0.00121)
Debt	-0.000358**	-0.000272*			6.19e-07	4.50e-07
	(0.000167)	(0.000161)			(1.81e-05)	(2.34e-05)
Balance unreserved	0.0147	0.0292**			0.00152	0.00152
	(0.0119)	(0.0127)			(0.00146)	(0.00163)
Bond rating	0.280*	0.328**			0.00893	-0.00201
	(0.148)	(0.159)			(0.0162)	(0.0164)
Balanced budget	-0.392	-0.166			-0.0306	-0.0205
	(0.533)	(0.541)			(0.0645)	(0.0681)
Union	0.0257*	0.0336**			0.00669***	0.00545**
	(0.0137)	(0.0140)			(0.00177)	(0.00209)
Fund ratio			0.163	0.169*	-0.00872***	-0.00971***
			(0.0990)	(0.101)	(0.00223)	(0.00223)
Equities			0.0170	0.0281	0.000897	0.00229
			(0.0187)	(0.0195)	(0.00152)	(0.00160)
Real estate			-0.0422	-0.0402	0.00372	0.00378
			(0.0633)	(0.0609)	(0.00544)	(0.00612)
Alternatives			0.0480	0.0366	0.0167***	0.0161***
			(0.0461)	(0.0473)	(0.00396)	(0.00418)
Plan size			-0.234	-0.305**		
			(0.146)	(0.145)		
sp500			-0.0554	-0.0563		
			(0.0397)	(0.0409)		
Investment expense			-2.972**	-2.746**		
			(1.299)	(1.185)		
Constant	2.827	-1.287	-6.410*	-6.700*	7.549***	7.985***
	(3.558)	(2.882)	(3.805)	(3.419)	(0.326)	(0.308)
Observations	722	690	816	784	908	860
R-squared	0.900	0.901	0.659	0.657	0.352	0.296

*** p<0.01, ** p<0.05, * p<0.1

Table 9 presents the Arellano-Bond regressions, with an alternative specification including time interactions for the relatively time-invariant governance variables. In the regression for the funding ratio, the previous negative results associated with board composition changes are still there, but the variables are no longer statistically significant. On the other hand, changes in board composition appear to be marginally significant and positive with regards to investment return. The results confirm the negative impact of changes in training requirements on investment performance. The results for the assumed rate of the return have not changed significantly, but it was not impacted by the missing values problem because those variables were not included in the regressions.

The coefficients for the interactions of the governance variables with time show the changes in the coefficient of the particular variable, for example, appointed trustees, over time. Although there is no information about the actual coefficient, the interactions with time can show if there are changes in that coefficient that may be of interest to the results. There are not that many significant interactions in the equations for the funding ratio and investment return. It does appear that changes in the coefficients for annual reports and investment performance evaluations were negative in the beginning of the decade. More interestingly, the coefficients for expertise becomes positive for investment return, but with significant negative changes during the latter part of the decade, after 2006. In hindsight, if more expert trustees considered the new and risky investments that brought the market down in 2008 as a good option, that may be associated with the negative trend in this coefficient.

Table 9. Arellano-Bond Regressions, Difference GMM, Imputed Data

	(1) Fund ratio	(2) Investment return	(3) Assumed rate	(4) Fund ratio	(5) Investment return	(6) Assumed rate
Lag fund ratio	0.943***	-0.550**	0.00553	0.920***	-0.548**	0.00557
	(0.0838)	(0.251)	(0.00395)	(0.0982)	(0.221)	(0.00365)
Invest return	0.143**			0.191**		
	(0.0721)			(0.0755)		
Elected	-0.152	0.735*	-0.00482	-0.313	0.570	-0.00360
	(0.220)	(0.423)	(0.00657)	(0.297)	(0.437)	(0.00664)
Appointed	-0.216	0.733*	-0.00479	-0.321	0.509	-0.00327
	(0.189)	(0.422)	(0.00639)	(0.282)	(0.425)	(0.00644)
Exofficio	-0.225	0.755	-0.00600	-0.294	0.330	-0.00383
	(0.202)	(0.461)	(0.00657)	(0.273)	(0.484)	(0.00664)
Board size	-1.159*	3.929**	-0.0111	-1.725**	2.784*	-0.0125
	(0.663)	(1.912)	(0.0127)	(0.714)	(1.643)	(0.0131)
Expertise	-0.366	7.982	0.0126	-4.819	16.19***	-0.0410
	(3.598)	(7.131)	(0.0539)	(3.645)	(4.816)	(0.0546)
Training	3.663	-19.39***	0.0375	7.157**	-20.78***	0.0363
	(3.099)	(6.854)	(0.0599)	(3.300)	(5.416)	(0.0605)
Lag benefit incr	6.288*			8.891*		
	(3.624)			(4.743)		
Change rev	-0.0149		0.00111*	-0.0161		0.00103
	(0.0528)		(0.000619)	(0.0522)		(0.000630)
Debt	-0.00186		-4.10e-05**	-0.00121		-3.87e-05**
	(0.00163)		(1.77e-05)	(0.00183)		(1.76e-05)
Balance	-0.0423		-0.000873	-0.0441		-0.000936
	(0.0355)		(0.000614)	(0.0382)		(0.000627)
Bond rating	0.0103		-0.00791	0.0264		-0.00923
	(0.605)		(0.00754)	(0.674)		(0.00745)
Union	0.0443		-5.45e-05	0.0635		-0.000537
	(0.100)		(0.00130)	(0.118)		(0.00133)
y02	-3.334***	2.257	0.0126	17.76**	-12.96**	-0.0384
	(1.196)	(3.991)	(0.0216)	(8.587)	(6.347)	(0.102)
y02elect				-0.140**	0.0223	0.00111
				(0.0679)	(0.0595)	(0.000928)
y02appoint				-0.172**	0.0692	0.000442
				(0.0856)	(0.0624)	(0.000986)
y02exofficio				-0.0851	0.114	0.000343
				(0.121)	(0.0851)	(0.00137)
y02report				-3.453	1.721	
				(2.308)	(1.990)	
y02eval				-8.199***	10.20***	
				(2.505)	(3.306)	
y02expertise				-0.0445	-2.249	0.0326
				(2.043)	(1.819)	(0.0277)
y02training				4.505*	-0.431	-0.0218
				(2.684)	(1.913)	(0.0278)
y03	-6.039***	13.31***	0.00338	2.324	-2.738	0.0696
	(1.505)	(4.334)	(0.0208)	(8.733)	(12.16)	(0.0906)
y03elect				-0.0309	-0.0208	0.000130
				(0.0690)	(0.0748)	(0.000847)

Table 9 Continued

y03appoint				-0.0331	-0.0210	-0.000713
				(0.0705)	(0.0833)	(0.000902)
y03exofficio				0.00690	-0.0687	-0.00173
				(0.0972)	(0.100)	(0.00119)
y03report				-4.831**	1.061	
				(2.340)	(2.816)	
y03eval				-7.212**	9.509***	
				(3.129)	(3.177)	
y03expertise				0.750	1.416	0.0525**
				(2.286)	(2.376)	(0.0255)
y03training				3.616	-2.949	-0.0278
				(2.782)	(2.138)	(0.0225)
y04	-2.950*	19.12***	-0.0168	-8.470	4.752	0.0979
	(1.634)	(4.504)	(0.0137)	(7.022)	(11.72)	(0.0873)
y04elect				0.0440	0.0624	-0.000528
				(0.0607)	(0.0915)	(0.000808)
y04appoint				0.0215	0.115	-0.00167*
				(0.0639)	(0.0960)	(0.000855)
y04exofficio				0.0305	0.272*	-0.00255**
				(0.0908)	(0.139)	(0.00115)
y04report				-2.009	-0.0849	
				(1.832)	(2.694)	
y04eval				0.738	0.411	
				(2.342)	(2.816)	
y04expertise				-0.494	-4.900	0.0461**
				(1.846)	(2.988)	(0.0230)
y04training				3.473*	-2.443	0.0255
				(2.076)	(2.799)	(0.0231)
y05	-0.994	14.00***	-0.00337	0.382	6.542	0.121
	(1.387)	(3.533)	(0.0121)	(6.418)	(9.557)	(0.0772)
y05elect				0.00769	-0.0104	-0.000646
				(0.0522)	(0.0870)	(0.000751)
y05appoint				-0.0440	0.0637	-0.00182**
				(0.0516)	(0.0912)	(0.000789)
y05exofficio				-0.0122	0.213	-0.00270**
				(0.0671)	(0.143)	(0.00109)
y05report				-1.412	0.108	
				(1.561)	(2.568)	
y05eval				0.644	0.697	
				(3.040)	(2.807)	
y05expertise				-0.145	-5.069*	0.0618***
				(1.428)	(3.052)	(0.0217)
y05training				0.268	0.783	0.0197
				(1.545)	(2.472)	(0.0204)
y06	0.432	14.73***	-0.000638	-5.231	9.122	0.0938
	(1.637)	(2.749)	(0.0148)	(7.777)	(12.00)	(0.0798)
y06elect				0.0445	-0.01000	-0.000505
				(0.0615)	(0.105)	(0.000829)
y06appoint				0.00796	0.0456	-0.00159*
				(0.0588)	(0.113)	(0.000841)

Table 9 Continued

y06exofficio				0.00389	0.233	-0.00176
				(0.0838)	(0.149)	(0.00113)
y06report				0.682	1.453	
				(1.799)	(2.239)	
y06eval				1.744	-2.508	
				(2.392)	(1.605)	
y06expertise				-1.378	-5.838**	0.0376*
				(1.720)	(2.866)	(0.0207)
y06training				2.355	2.375	0.0301
				(1.847)	(2.655)	(0.0197)
y07	2.867	18.29***	0.0331	-3.516	15.30	0.101
	(2.057)	(2.082)	(0.0236)	(7.430)	(11.18)	(0.0733)
y07elect				0.0164	0.0316	-0.000349
				(0.0612)	(0.136)	(0.000792)
y07appoint				-0.00799	0.0958	-0.00125
				(0.0669)	(0.148)	(0.000840)
y07exofficio				0.000215	0.334*	-0.00140
				(0.0887)	(0.175)	(0.00115)
y07report				0.140	0.181	
				(1.940)	(3.215)	
y07eval				5.775**	-5.159***	
				(2.561)	(1.867)	
y07expertise				0.124	-8.545**	0.0358*
				(1.595)	(3.852)	(0.0201)
y07training				-0.873	4.234	0.0207
				(1.557)	(3.296)	(0.0196)
y08	3.308***		0.0262	3.394		0.0592
	(0.935)		(0.0180)	(7.066)		(0.0708)
y08elect				0.0386	0.0852	9.86e-05
				(0.0684)	(0.153)	(0.000693)
y08appoint				-0.0174	0.227	-0.00108
				(0.0700)	(0.167)	(0.000737)
y08exofficio				-0.0451	0.609***	-0.00105
				(0.105)	(0.222)	(0.00102)
y08report				-1.513	-0.733	
				(1.604)	(4.118)	
y08eval				-0.0270	-7.553**	
				(1.445)	(2.995)	
y08expertise				3.958**	-13.37***	0.0483**
				(1.828)	(4.361)	(0.0209)
y08training				-1.202	5.444	0.0176
				(1.736)	(4.101)	(0.0195)
Fiscal year	-0.0942	2.029	-0.0126***	-0.110	-2.876	-0.00824*
	(0.362)	(4.156)	(0.00461)	(0.377)	(3.084)	(0.00480)
Fund ratio		1.079	-0.00551		-0.0333	-0.00445
		(1.366)	(0.00441)		(0.996)	(0.00414)
Equities		0.111***	-0.000212		0.0917**	-0.000347
		(0.0420)	(0.000306)		(0.0374)	(0.000308)
Real estate		-1.041***	0.00238		-0.864***	0.00149
		(0.344)	(0.00185)		(0.264)	(0.00188)

Table 9 Continued

Alternatives		-0.430***	-9.97e-05		-0.331*	0.000201
		(0.153)	(0.00135)		(0.177)	(0.00137)
Plan size		-43.93			21.73	
		(74.63)			(56.18)	
sp500		-0.00684			0.213	
		(0.0453)			(0.291)	
Invest expense		-18.42***			-15.73***	
		(5.261)			(4.787)	
Observations	631	717	798	631	717	798
Number of planid	95	97	110	95	97	110

The interaction results for the assumed rate of return also have several interesting trends. One is that the coefficients for appointed and exofficio trustees were associated with lower assumed rates of return in 2004 and 2005, which may be due to adjustments for the market losses in the early 2000s. If this is the case, it does indicate the trustees adjusted assumed rates in response to lower investment returns and were not influenced politically. However, expertise has consistent positive interaction coefficients throughout the period. So, for boards that had expertise requirements, the impact of these requirements over the period resulted in positive changes in the coefficient for expertise. A negative coefficient for the level effect of board expertise would imply that boards with expert trustees are likely to have lower assumed rates of return, holding constant asset allocation. Positive changes in the coefficient over the period would imply that boards with experts had higher assumed rates of return, indicating they did not take into account the poor investment returns at the beginning of the period. One explanation for this can be that boards with experts might have expected upward corrections in the market and did not consider the losses a predictor of lower average long-term returns.

Table 10. 3SLS and 2SLS, Imputed Data

	3SLS Fund ratio	3SLS Invest return	3SLS Assumed rate	2SLS Fund ratio	2SLS Invest return	2SLS Assumed rate
Lag fund ratio	0.336***	-0.990***	0.00252***	0.325***	-0.831***	0.00211**
	(0.0554)	(0.118)	(0.000942)	(0.0567)	(0.120)	(0.000960)
Invest return	0.183***			0.177***		
	(0.0333)			(0.0342)		
Elected	-0.0608	0.223	-0.00436	0.00249	0.0153	-0.00368
	(0.648)	(1.586)	(0.0127)	(0.662)	(1.616)	(0.0129)
Appointed	-0.0945	0.267	-0.00349	-0.0317	0.0259	-0.00274
	(0.644)	(1.574)	(0.0126)	(0.658)	(1.604)	(0.0129)
Exofficio	-0.162	0.115	-0.00432	-0.106	-0.174	-0.00345
	(0.645)	(1.580)	(0.0126)	(0.659)	(1.610)	(0.0129)
Board size	0.922	1.827	-0.0140	0.941	2.718	-0.0164
	(1.001)	(2.485)	(0.0199)	(1.022)	(2.534)	(0.0202)
Expertise	-10.05***	22.32**	0.0300	-9.875***	18.21**	0.0409
	(3.474)	(8.785)	(0.0688)	(3.548)	(8.982)	(0.0701)
Training	6.853**	-24.47***	0.0209	6.634**	-23.46***	0.0173
	(3.235)	(7.946)	(0.0619)	(3.303)	(8.114)	(0.0630)
Lag benefit increase	0.943			1.256*		
	(0.606)			(0.652)		
Change revenues	-0.00459		0.00105*	-0.0211		0.000982*
	(0.0263)		(0.000545)	(0.0283)		(0.000558)
Debt	-0.00113		-5.04e-05**	-0.00178*		-5.29e-05***
	(0.000973)		(1.98e-05)	(0.00104)		(2.03e-05)
Balance	0.0350		-0.000934	0.0286		-0.00104
	(0.0332)		(0.000690)	(0.0357)		(0.000706)
Bond rating	1.224***		-0.000170	1.258**		-0.00195
	(0.474)		(0.00981)	(0.507)		(0.0100)
Balanced budget	0		0	0		0
	(0)		(0)	(0)		(0)
Union	0.0369		0.00104	0.0192		0.000887
	(0.0734)		(0.00152)	(0.0790)		(0.00155)
Fund ratio		-0.0725	-0.000574		-0.432	0.00124
		(0.809)	(0.00115)		(0.853)	(0.00118)
Equities		0.175***	-0.000175		0.223***	-0.000286
		(0.0580)	(0.000451)		(0.0620)	(0.000461)
Real estate		-0.961***	0.00376*		-1.185***	0.00431*
		(0.279)	(0.00227)		(0.298)	(0.00232)
Alternatives		-0.521**	-0.000974		-0.680***	-0.000599
		(0.207)	(0.00155)		(0.221)	(0.00159)
Plan size		95.30**			76.71	
		(47.85)			(50.50)	
sp500		0.0729***			0.0881***	
		(0.0209)			(0.0222)	
Investment expense		-15.99***			-17.57***	
		(4.221)			(4.521)	
Constant	-0.685**	-4.973**	-0.00982	-0.654*	-4.854*	-0.00724
	(0.327)	(2.520)	(0.00614)	(0.336)	(2.653)	(0.00626)
Observations	505	505	505	505	505	505
R-squared	-0.049	0.281	0.040	-0.036	0.305	0.058

*** p<0.01, ** p<0.05, * p<0.1

The results from the 3SLS regressions also have a couple of new findings. In the funding equation, the expertise variable has a negative and significant coefficient, while the training variable has a positive and significant coefficient. Changes in expertise requirements over the period are associated with negative changes in the funding ratio, while changes in training requirements are associated with positive changes in the funding ratio. On the other hand, the signs of the coefficients are reversed for investment return, where changes in expertise have a positive impact on investment returns, while changes in training requirements have a negative impact on investment. The training may have a positive impact on funding through training on fiduciary responsibilities. It may have a negative effect on investment return because the investment content is very difficult to understand, and board trustees who do not have any experience in the area may defer to experts for these decisions. One reason why expertise may have a negative effect on funding is suggested by the Arellano-Bond results for the assumed rate. If experts did not consider it necessary to revise actuarial assumptions, contributions to the pension plan would be insufficient compared to the actual returns that were realized over the period. But experts did contribute to positive investment returns over the period.

CHAPTER 6. CONCLUSION

The goal of this study to was examine the determinants of public pension fund performance through the lens of agency theory. The study sought to answer the following questions: (1) How much of the fluctuation in the performance of pension plans is due to political interference – either directly from decisions made by legislatures or through the governance structure of the pension boards, after controlling for asset allocation, plan size, and other external factors? (2) Do pension board expertise, education and training, and information disclosure requirements improve the performance of pension plans? (3) Do pension trustees strategically determine the actuarial rate of return (discount rate) in order to reduce contributions in times of fiscal stress for the pension sponsor?

Most of the previous existing literature that attempted to address one or a combination of these questions used either cross-sectional data or pooled cross-sectional time-series data, which does not control for potential plan-specific fixed effects. This study replicated the pooled cross-section analysis, and added two instrumental variables methods (Arellano-Bond GMM and 3SLS) to the empirical analysis to try to control for endogeneity problems. Of particular concern was the lagged dependent variable in the funding equation that limited the available estimation methods.

The results from the empirical analysis presented here lend partial support for the agency hypotheses tested in this research. Specifically, there is not much direct evidence about the negative effect of political trustees on pension performance. However, the cross-section results suggest that active trustees are associated with better funding levels, while retired trustees are associated with lower funding levels. Earlier research (Murphy & Van Nuys, 1994: Yang &

Mitchell, 2005) finds a negative impact of retired trustees on investment return, but not on pension funding levels. These results support the hypothesis that active trustees may be the best representatives of the interests of pension members, while retirees may have some conflict of interest about pension funding because they do not directly bear the consequences of poor funding outcomes.

Fiscal stress variables are significant in the cross-section equations and some of them are significant in the differenced equations. However, fiscal stress does not appear to reduce pension funding through the assumed rate of return. At least in the period of study, it appears that fiscal stress influenced pension funding through direct reductions in the contributions to the pension plans versus indirect reductions through manipulation of the discount rate.

This analysis also presents the only known direct tests of the impact of financial management expertise and training on pension performance. Expertise has the expected positive effect on investment performance, however, it is associated with a negative effect on funding. It appears that pension expertise was associated with higher assumed rates of return during this period, which may be due to expectations that the market will return to its average high-return normal. On the other hand, training had a positive effect on pension funding levels, but a negative effect on investment return. The training usually provided to pension members includes training on all their responsibilities. However, the investment training is probably the most difficult topic, and as a result of this training plan trustees who do not have expertise may defer investment decisions to investment managers, which may be associated with lower investment returns.

So, what are the implications of this analysis for pension governance, pension performance, and future studies in this area? The main implication is that pension governance

does have some impact on the performance of pension plans. However, we still do not know enough about the political channels of influence and how these impacts contributions. The results do show that fiscal condition and fiscal stress most likely influence pension funding through contributions, because they do not appear to have any effect on the assumed rate of return.

The other implications from this study are that we need better measures of political influence. Some of the examples from the data collection process undertaken during this research include proper measurement of board composition, board characteristics, channels of political pressure, and politically-motivated investments, among others. The board composition variables are more diverse than the four categories into which different trustees are grouped. Appointed trustees may be politically affiliated, may be citizens who are not members of the pension system, or may be investment professionals who serve on the board because of their expertise. Further, appointed trustees may be plan members, which confounds the main difference between external and internal trustees. The current measures do not have any way to distinguish between these and measurement error may account for the lack of significant results in any direction.

Board characteristics are also important and need better measurement. These include expertise and training in this study, which were coded as binary variables, but there is tremendous variation in the extent of these requirements. Some pension systems have only one or two financial and investment experts on the boards, some more, and many just an ex-officio trustee. Training is required for some trustees or just offered as an opportunity to others. The extent and frequency of training varies, but there is not enough information about that at this point. Nor there is enough information about the quality of the training.

Another problematic variable that attempts to control for political interference with the pension funds is the percent of assets invested in the state. Many systems invest in-state but most of them do not keep track of that number or choose not to disclose it in surveys and annual reports. The response bias for this variable makes it impossible to use in data analysis as it is currently available. Furthermore, other channels of political interference need to be identified and measured. For example, it seems that there are different oversight mechanisms in place that could be categorized and tested in terms of their impact on pension performance. Some pension systems have to report to pension committees in the legislature and go through these for major legislative changes. The relative discretion of the board of trustees in different pension plans needs to be assessed and measured with some sort of continuous variable or a construct.

Finally, the most problematic variable for the purposes of this analysis is the dependent variable – the actuarial funding ratio. Due to the different plan characteristics, actuarial assumptions, and actuarial methods, it is impossible to compare the funding ratios of pension plans without some sort of common measure of assets and liabilities. Unfortunately, market value of assets data is not available at the plan level in this dataset. In the 1990s, pension systems published a liability measure that was based on the same actuarial cost method. Although this measure is still endogenous to different discount rates, it can be adjusted more easily (as reported in Chaney et al., 2002) than the currently reported liabilities.

The new GASB accounting and reporting requirements are going to be a step in the right direction in terms of addressing the limitations encountered in this study. Specifically, GASB is planning to require pension plans to use a single actuarial cost method, the entry age method, to value their liabilities. They are also requiring a lot more information about the pension plan, the pension governance structure, and investments, to be included in the CAFRs.

Generally, the best approach to furthering studies in this area would be to combine the development of quantitative measures with some qualitative studies that provide more information about the governance structures and the practices of public pension plans. The next step is to get better measures of funding status and board governance variables, as well as examine alternative mechanisms through which political influence may impact pension performance. The goal is to build a richer dataset that expands our understanding of pension systems, while at the same time advancing theoretical and empirical models about their performance. Another improvement on the existing studies, including the one presented here, would be to consider a better dependent variable than the actuarial funding ratio. One approach would be to measure pension performance as a deviation from some kind of benchmark. Such a measure would be able to better capture differences in pension performance when compared to the actuarial funding ratio, which changes very slowly due to its cumulative effect.

APPENDIX 1

Previous studies on governance, financial management, and public pension fund performance in the United States

Authors	*Data/Methods*	*Research Question*	*Results*
Chaney et al. 2002	State CAFRs N=48	Do fiscal stress and balanced budget requirements affect the funding of pension plans?	• Fiscally stressed states with balanced budget requirements have lower funding ratios by choosing a higher discount rate.
Coronado et al. 2003	PENDAT 1998	Does political influence impact investment return?	• Elected trustees are associated with a positive, but insignificant effect on investment return. • In-state investments and investment restrictions are associated with negative, but insignificant effects on investment return. • Controlling for these factors and asset allocation, public plans still have lower investment returns than private plans.
Eaton & Nofsinger 2004	PENDAT 1990, 1991, 1992, 1994, 1996	What is the effect of fiscal constraints and political pressure on actuarial assumptions and funding?	• Actuarial assumptions are manipulated in states with fiscal constraints. • Funding levels are lower for plans experiencing fiscal stress and political pressure.
Harper 2008	Own dataset, 2001-2005 N=69	What is the impact of board composition on pension fund performance?	• Elected and ex-officio board members have a positive effect on funding level. • Larger boards and higher contribution rates have a negative effect on funding.
Hess 2005	PENDAT 1990, 1991, 1992, 1994, 1996, 1998, 2000 Sample size varies	What is the effect of governance and financial management practices on investment return?	• Economically targeted investments and shareholder activism do not impact investment performance. • Appointed trustees have a positive impact on investment performance, and elected trustees have a positive, but diminishing effect on investment performance. • Asset allocation decisions by the board, automatic disclosures and ethics codes are associated with lower investment performance.
Hsin & Mitchell 1997	PENDAT 1992 N=476	What are the determinants of actuarial assumptions and pension contributions?	• Elected board members choose lower assumed interest rate and spread rate, and even more so with fiscal stress, but fiscal stress by itself increases assumed rates.

			• Less funded plans choose assumptions lowering their required contribution. • Elected trustees and carryover of budget deficit have a positive effect on contributions, while fiscal stress has a negative effect.
Murphy & Van Nuys 1994	Own dataset, 1988-1992	How does governance affect the behavior and performance of state and corporate pension plans?	• Retirees on the board of trustees are associated with lower investment returns. • Active members on the board of trustees are associated with higher funding levels.
Romano 1993	Own dataset, 1985-1989 N=250	What is the impact of governance on investment return and shareholder activism?	• Political members (appointed and ex-officio) are associated with lower investment returns.
Useem & Mitchell 2000	PENDAT 1992, 1993 N=291	What is the effect of governance on financial management strategies and performance (investment return)?	• Governance factors have a significant effect on investment strategies. Among those are constitutional restrictions on investment, independent performance evaluations, and asset allocation responsibility. • Investment return is primarily determined by investment strategies, not governance factors.
Yang & Mitchell 2005	PENDAT 1990, 1991, 1992, 1994, 1996, 1998, 2000 N=566	How governance and investment strategies affect funding status and investment performance?	• Elected board members and dedicated tax for contributions are associated with lower funding levels. • Fiscal stress and carryover of budget deficit have no effect on funding. • Annual report has a positive effect on investment return. • Retiree members on the board have a negative effect on investment return.

APPENDIX 2

Pension System Survey Questionnaire

Opening page

This electronic survey includes detailed questions about your system's governance structure, disclosures, and benefit changes since FY 2000. There are a total of 27 questions. Some questions ask you to provide a number, some ask you to select all appropriate responses, and some require explanations and text information. The survey should take about 20 to 30 minutes to complete.

If you prefer not to answer a particular question, select "no response" in order to continue to the next set of questions. Once you have completed a section and selected "Submit", you cannot go back to it to revise it. However, the survey is set up so that you can stop it and return to the same section at a later time. In order to do that, you need to close your browser to exit the survey. Note that information on that page will NOT be saved until you press "Submit". You can re-start the survey from the link provided in the email and it will take you to the last page you viewed before exiting the survey.

Thank you for your time and participation!

1. Please provide the full name of the Pension System:
2. Name and Position of person completing the survey:
   _____

   □ Contact information:

   Address:
   Phone:
   Fax:
   Email:

3. Check type of governmental unit that provides day-to-day administration for the System?

   □ State
   □ County
   □ Municipal/Township
   □ Independent
   □ Other, please specify _____

4. Indicate using numbers the composition of the Pension Board:	# Appointed: _____ # Elected by plan members: _____ # Ex-officio:_____ # Other:_____ Total:_____

5. Indicate by number if Pension Board trustees are members of the pension system:	# Active members: _____ # Retired members: _____ Total:_____

6. What is the term of office of Pension Board trustees, in years:

7. How many terms may a trustee serve?

8. What are the minimum education requirements for Pension Board trustees?

- None
- High School Graduate
- College Graduate
- Professional (Masters/PhD) Degree
- Certificate (i.e. CPA, CFA)
- Other, please specify _____

9. Is there a minimum experience requirement for Pension Board trustees?
   - Yes
     If yes, please specify _____
   - No

10. Is training **required** of Pension Board trustees?
    - □ Yes
      If yes, please specify training requirement, topics covered and frequency of training:
      _____
      _____
    - □ No

11. Is training **offered** to Pension Board trustees?
    - □ Yes
      If yes, please specify topics covered and frequency of training offered:
      _____
      _____
    - □ No

12. Check all functions for which this Pension Board has controlling authority:
    - □ Investments
    - □ Actuarial Assumptions
    - □ Benefit Levels
    - □ Operating Budget
    - □ Other, please specify _____

13. Check all investment guidelines or restrictions that the Pension Board must operate under:
    - □ Prudent Person
    - □ State Legal List, please specify _____
    - □ Other, please specify _____

14. Are investment restrictions that apply to this System specified in your state's constitution?

□ Yes
□ No

15. Does the state constitution address the use of System funds for purposes other than those pension related?
□ Yes
If yes, please specify
_____
_____
□ No

16. Does the state statute specify the employer contribution rate to the pension system?
□ Yes
If yes, please specify the statutory employer contribution rate(s) for fiscal year 2008 in percent: _____
□ No

17. Is there a dedicated state tax for contributions into this System?
□ Yes
□ No

18. Does the System obtain independent investment performance evaluations?
□ Yes
If yes, what is the frequency of performance evaluations? _____
□ No

19. Is an internal control audit (distinct from a financial audit) performed by a qualified independent auditor (or internal auditor with independent authority)?
□ Yes
If yes, what is the frequency of internal control audits? _____
□ No

20. Is an annual financial report/summary automatically sent to all pension members?
□ Yes
If yes, check all manners of distribution that apply:
□ Electronically
□ Hard copy, regular mail
□ Other, please specify _____
□ No

21. What percent of this System's assets are:	Internally managed: _____ Invested in indexed instruments: _____ Invested in-state:_____

22. Were benefit increases to this System enacted for the period 2000 - 2008?
□ Yes
If yes, please provide detailed information about the type of benefit increases

(e.g. COLA increases, benefit multiplier, minimum years to receive benefits, etc).

_____

_____

 No

23. Would you like to get summary results from this survey?

Yes

If yes, please provide an email address

_____

No

24. Thank you for completing the survey. If you have any comments to share about the questions, please include a brief statement here. Also, if you encountered any technical problems, please let us know.

APPENDIX 3

Variable Definition and Measurement

Variable Name	Definition	Measurement
Funding Ratio	Ratio of actuarial assets to actuarial liabilities for each fiscal year	Percent
Investment Return	The annual investment gain or loss divided by assets	Percent
Assumed Rate of Return	Average return on pension assets over a long period of time	Percent
Elected Trustees	Number of elected trustees divided by total number of trustees	Percent
Appointed Trustees	Number of appointed trustees divided by total number of trustees	Percent
Ex-officio Trustees	Number of trustees appointed to the board because of the position they hold divided by total number of trustees	Percent
Board Size	Total number of trustees on board	Number
Board Expertise	Whether financial expertise is required to serve on the board – at least one member	Yes=1; No=0
Board Training	Whether regular training on board functions is provided to trustees	Yes=1; No=0
Annual Report	Annual financial report/summary mailed to pension plan members, excludes electronically available online	Yes=1; No=0
Performance Evaluation	Independent investment performance evaluation conducted at least annually	Yes=1; No=0
Statutory Contribution	The employer contribution to the pension fund is determined by statute.	Yes=1; No=0
Equities	Percent of assets invested in domestic and	Percent

	international equities	
Real Estate	Percent of assets invested in real estate	Percent
Alternatives	Percent of assets invested in alternative investments	Percent
In-state Investments	Percent of assets invested in the state	Percent
Investment Expense	Investment expenses divided by system assets	Percent
Benefit Increases	Benefit increases approved and in effect for that fiscal year.	Yes=1; No=0
Year-end Balance	State year-end balance in the general fund plus rainy day fund divided by general fund expenditures	Percent
Debt	State debt at the end of fiscal year per capita	Number
Tax Revenue	Change in own source revenues from previous year	Percent
Bond Rating	Moody's bond rating by state	1=Baa1, 2=A3; 3=A2; 4=A1; 5=Aa3; 6=Aa2; 7=Aa1; 8=Aaa
Balanced Budget	State required to balance budget at the end of fiscal year	Yes=1; No=0
Union	Percent of state public employees covered by a collective bargaining agreement	Percent
Plan Size	Log of plan assets	Number
S&P500	S&P500 annual return	Percent
Investment Council	Investment authority with a separate investment council, not board of trustees	Yes=1; No=0
Active Ratio	The ratio of active to retired pension plan members	Number
Amortization Period	Number of years over which unfunded actuarial liabilities are expected to be paid off	Number
Entry Age Normal	Actuarial cost method used to calculate liabilities	Yes=1; No=0
Prudent Person	The presence of prudent person standard for the management of the pension investments	Yes=1; No=0

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